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EDWARD JACKSON'S PLACE IN THE HISTORY OF REFRACTION

FIRST JACKSON MEMORIAL LECTURE*

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To understand the part played by Edward Jackson in the development of the technique and the teaching of refraction, it seems advisable to review some of the steps which led to our modern knowledge of the subject.

Much of the important work on refraction originated in England and in the United States. One important exception is the famous volume by Donders,[5] a clinician of Utrecht, Holland; but the complete form of this volume first came before the medical public in an English translation.

It is probable that the first type of refractive error to be subjected to anything like systematic correction was myopia. In 1629, Charles the First of England granted a charter to "The Worshipful Company of Spectacle Makers," one of the organizations which now confer upon British opticians certificates of proficiency in the measurement of optical defects of the eye. It will be remembered that Benjamin Franklin is said to have designed, in 1777, the first pair of bifocal spectacles.

For a long time the terms "presbyopia" and "farsightedness" were used synonymously. The development of a knowledge of astigmatism is relatively recent. Thomas Young, the English physicist, is credited with the first scientific observation of this ocular defect, correction of which now occupies so large a part of the time of almost every conscientious and well-qualified ophthalmologist.

On November 27, 1800, Thomas Young, M.D. and Fellow of the Royal Society, delivered before that Society his Bakerian lecture[22] "On the mechanism of the eye." In that lecture Young described the optical condition of his own eyes, together with certain means of measuring the condition, including a simple optometer. He was strongly myopic as well as astigmatic.

"My eye," he says, "in a state of relaxation, collects to a focus on the retina, those rays which diverge vertically from an object at a distance of ten inches from the cornea, and the rays which diverge horizontally from an object at seven inches distance." Further on he remarks: "The shortest distance of perfect vision in my eye is 26 tenths of an inch for horizontal, and 29 for vertical rays." He adds that he has never experienced any inconvenience from this imperfection! Elsewhere, reference is made to the fact that "Many persons were obliged to hold a concave glass obliquely, in order to see with distinctness, counterbalancing, by the inclination of the glass, the too great refractive power of the eye in the direction of that inclination. . . ."

Young's astigmatism was exceptional

* Presented at the forty-ninth meeting of the American Academy of Ophthalmology and Otolaryngology, October 8-12, 1944.

in two respects. It was what we call inverse, the horizontal meridian having the stronger plus focus. It appears also to have been chiefly lenticular, for one of Young's experiments on his own eye showed that his astigmatism was not abolished when the cornea was immersed in water.

One of Young's scientific activities in relation to the eye consisted of refuting the current belief that the crystalline lens contained muscle fibers. For modern research workers there may be consolation in the following incidental confession of a great scientist: "I beg leave," he says, "to correct here an observation in my former paper, relative to the faint lateral radiations, which I supposed to proceed from the margin of the iris. I find, on further examination, that they are occasioned by reflections from the eyelashes."

Little practical benefit seems to have followed Young's description. But in 1827 Airy,[1] the British Astronomer Royal, reporting before the Cambridge Philosophical Society, described his own case of compound myopic astigmatism and the means taken for its correction. He had observed that the image made in his left eye by a bright point, such as a star or a distant lamp, was not circular but elliptical, the major axis being 35 degrees from the vertical, its upper extremity inclined to the right. He found that, if he drew two lines crossing each other at right angles and placed the paper at a proper distance, one line appeared perfectly distinct while the other could scarcely be seen. On bringing the paper closer to the eye the relation between the two lines was reversed. After "various ineffectual attempts" the construction of the necessary cylindrical lens was accomplished by an Ipswich optician named Fuller, a concave spherical curvature being ground on one side of the lens and a concave cylindrical on the other.

Airy seems to have made one mistake. Toward the end of his short report he says: "I have not been able to discover that this construction has been used to correct any defect in the eye, or even that a defect similar to that which I have described, has ever been noticed." Thus Airy appears to have been unfamiliar with the observation made forty years earlier by Thomas Young.

How many recognized cases of this sort escaped notice in the medical literature, or in that part of it which has been accessible to me, I cannot say. Under the head of "Particular kinds of nervous affections," the first edition, 1833, of "A treatise on diseases of the eye," by the British surgeon William Lawrence,[17] mentions nearsightedness and farsightedness but makes absolutely no reference to astigmatism. An American edition of Lawrence's work, edited in 1854 by Isaac Hays, Surgeon to Wills Hospital, quotes at length the account by an American clergyman of his own case of astigmatism, which is said to have been corrected with lenses furnished by a Philadelphia optician named McAllister.

In these early cases the estimation of the meridians of astigmatism seems to have been arrived at by the simple expedient of discovering the direction of distortion of the image of a light seen through a small hole in a black card. One supposes that the conclusions as to the meridian or axis, and as to amount of cylinder, may have been somewhat crude.

The section of abstracts of communications to the British Association for the Advancement of Science for the year 1849 contains a brief communication[21] by Professor Stokes, the well-known mathematician and physicist, "On a mode of measuring astigmatism in a defective eye." This ingenious device, which may to some extent be regarded as the basis of the Jackson cross-cylinder test

for the amount of astigmatism, is described in the following terms: "If two planocylindrical lenses of equal radius, one concave and the other convex, be fixed one in the lid and the other in the body of a small round wooden box, with a hole in the top and bottom, so as to be as nearly as possible in contact, the lenses will neutralize each other when the axes of the surfaces are parallel; and, by merely turning the lid round, an astigmatic lens may be formed of a power varying continuously from zero to twice the astigmatic power of either lens. When a person who has the defect in question has turned the lid till the power suits his eye, an extremely simple numerical calculation, the data for which are furnished by the chord of double the angle through which the lid has been turned, enables him to calculate the curvature of the cylindrical surface of a lens for a pair of spectacles that will correct the defect of his eye."

One form of the Stokes lens is depicted on page 486 of the English edition of Donders. At the 1887 meeting of the American Ophthalmological Society, held in New London, Connecticut, W. F. Dennett[3] of New York described and illustrated a special form of the Stokes lens, intended for mounting in a trial frame, and designed to permit not merely of variation in the strength of the cylinder but of adjustment of its principal meridians to any position in the trial frame. Dennett's introductory paragraph seems worth quoting. He says: "The Stokes lens seems hitherto to have been possessed of some intangible and unattainable value as an astigmometer. There are at least four different instruments, the independent inventions of as many different men, in which this lens is the principal factor, but up to the present time it has ranked as little better than an interesting toy."

It is advisable to repeat and to emphasize that the Stokes lens served merely to give an approximate measurement of well-marked astigmatic errors, upon the basis of an axis previously established by other means, or sometimes by turning of the whole apparatus in the hand of the patient or observer.

In the course of the present address, further reference will be made to Jackson's teachings with regard to cross, or crossed, cylinders. But it may be observed at this point that his work in this field is typical of Jackson's general relation to medical science. To very few medical workers is given the privilege of offering to the world something completely new. In fact, it may be said without contradiction that every new thought or invention is based upon the sum total of previous human knowledge in the given field. But Jackson surveyed every department of his chosen work with penetration and insight and with unremitting labor; and in several phases of refraction work, including the measurement of astigmatism with cross cylinders, he made important refinements and improvements upon what had been proposed by others.

The period of greatest advance in measurement of the refraction of human eyes will be forever associated with the name of F. C. Donders. This clinician's researches at the University of Utrecht led to his publishing in 1860, in the Dutch language, an essay upon "Ametropia and its results" (Ametropie en Hare Gevolgen). In the preface to that work the author announced his intention of producing a complete system of the anomalies of refraction and accommodation, including the subject of astigmatism. A little later Donders was requested by the New Sydenham Society, of England, to prepare his essay for an English edition. He responded with a treatise of about six hundred pages in which the whole sub-

ject was exhaustively covered. The manuscript was ably translated by William Daniel Moore of Dublin.

Since the time of Donders, differences of opinion and changes of technique have developed; but as to essentials it is difficult to find any branch of the subject that is not included in the scope of Donders's thought and experience. His volume even has something to say about aniseikonia, although not under that title. Some years ago I ran across a statement that biastigmatism, or the occurrence of distinct and usually conflicting astigmatisms in the cornea and the crystalline lens of the same eye, had been first discovered in or about 1909. I had little difficulty in confirming my suspicion that Donders had clearly referred to this phenomenon in 1864 in his work on accommodation and refraction. He also quite correctly pointed out that bicylindrical lenses, with intersecting axes, could always be advantageously replaced by spherocylindricals.

You will remember that Jackson's brief period of practice of general medicine was cut short by an attack of diphtheria which was followed by many months of incapacity from postdiphtheric paralysis involving the leg muscles and ocular accommodation. It was during this spell of physical incapacity that he familiarized himself "through and through" with Donders's epoch-making working.

What contrasts may we find between refraction before and after Donders? Or again, what changes did the refractive technique of Jackson's active years show in comparison with the precepts laid down by the Dutch teacher?

In the field of ophthalmology, the textbook of William Mackenzie[18] seems to have filled, for many years, much the same authoritative and universal position as has been occupied in modern times by William Osler's "Practice of medicine." Mackenzie was "Lecturer on the Eye in the University of Glasgow, and one of the surgeons of the Glasgow Eye Infirmary"; later "Surgeon-Oculist in Scotland to her Majesty" Queen Victoria.

Mackenzie's first edition was published in England in 1830. A first American edition, containing 719 pages, appeared in 1833. The fourth American edition, published in Philadelphia in 1855, had 1,027 pages of larger size.

It is not altogether surprising that the 1833 and the 1855 editions of Mackenzie's treatise devoted extremely little space to refractive errors. Even in the fourth edition, asthenopia, considered as a disease, was attributed to many causes, among which refractive error fails to be included. Myopia and presbyopia were contrasted as two opposite conditions, approximately as myopia and hyperopia are contrasted today. We are, however, told that "young men of twenty sometimes cannot see to read or write without convex glasses of six or eight inches focus."

As to astigmatism, the earlier English edition of Mackenzie is silent. In the 1855 American edition, the two-and-a-half pages devoted to an explanation of astigmatism are chiefly occupied with a record of the famous case of the astronomer Airy. Mention is made of the clergyman Whewell's proposal of the word "astigmatism," also of the several cases which had been published in the literature, and of the Stokes lens.

Speaking in 1833 of "presbyopia or farsightedness," the English surgeon and ophthalmologist Lawrence advises that glasses for its correction "must be chosen . . ." so as to "enable the person to see without straining or fatiguing the organ, and should only be worn for reading, writing, or examination of near objects."

By both Mackenzie and Lawrence a good deal of space was devoted to dis-

cussion of asthenopia and theories as to its causation. Mackenzie was quite pessimistic on the subject. "In many cases," he said, "it is our duty to declare the disease incurable. . . . Many a poor man have I told to give up a sedentary trade, and drive a horse and cart; while to those in better circumstances, and not far advanced in life, I have recommended emigration. . . ."

Donders, commenting on some further remarks by Mackenzie, says: "There is no doubt that Mackenzie gave far too weak glasses." While admitting that many other conditions had often been mistaken for asthenopia, Donders boldly asserted that the cause of "the pure form of asthenopia" lay in hyperopia, and that asthenopia was not the fatigue associated with looking at other objects, but the want of power through which the fatigue occurred.

Reference may be made to what Donders stigmatizes as "a melancholy page in the history of operative ophthalmic surgery," the fact that certain practitioners, attributing asthenopia to spastic contraction of external eye muscles, "had the courage to cut through the muscles." This practice Donders justifiably characterizes as belonging "to the fables of the period of operative mania."

The correction of myopia with spectacles is usually thought of as a rather simple matter. In earlier times, its understanding and the practical results obtained were commonly much complicated by complete, or almost complete, ignorance regarding astigmatism, since the myopic eye with an appreciable amount of astigmatism could not be perfectly corrected with a simple concave sphere.

We find Lawrence, in 1833, advising his readers that "from the use, under proper precautions, of such concave glasses as will rectify the error in the refractive power, the nearsighted person need not apprehend any injury to the eye; indeed, the easy exercise of vision with the recognized optical aid, seems to me less hurtful than the straining and efforts to do without it." But he adds: "As there is some reason for concluding that the optical powers accommodate themselves to the circumstances under which vision is habitually exercised, I recommend nearsighted persons not to wear spectacles constantly. . . ."

Since in 1854 the American edition of Lawrence quotes at a good deal of length from Mackenzie's discussion of refraction, the latter British writer may probably be considered typical of opinion in Great Britain and America at the middle of the nineteenth century. For the myopic patient Mackenzie recommends "frequent exercise out of doors, walking and riding in the country, and travelling through new and interesting scenes." "If," he says, "instead of such a plan of conduct, recourse be had to the employment of concave glasses, and the frequent and long-continued observation of near objects be persisted in, the disease becomes not only confirmed but sometimes greatly aggravated. . . . We must recommend to the nearsighted person to be content with the shallowest glasses or lowest number which answers his purpose. . . . When a nearsighted person wishes to be fitted with concave glasses, the simplest and shortest plan is to try a series of them at an optician's shop. . . . If the nearsighted person is desirous of assistance in seeing remote objects . . . the focal distance of the glasses . . . should be the distance at which a small object appears distinct to his naked eye. For example, if he reads this type at 12 inches distance, 12 inches will be the focus of the concave glasses which he will require for seeing distant objects distinctly."

Hays, the American editor of Lawrence's fourth edition, has progressed to

the point of declaring that "presbyopia is not a defect of old age alone, it occurs also in young persons; and, if we may judge from the number of examples of this which have come under our observation, much more frequently than is generally supposed." A footnote to the same chapter states that "convex glasses are kept in the shops of every focal length, from forty-eight inches to six."

Donders clearly stated the refraction of the eye to be its refraction in the state of rest, "independently of accommodation . . . for example under the influence of atropine."

By the time Donders's volume was written he had the benefit of a few years of experience in the truths revealed by the ophthalmoscope. To him, the prescribing of spectacles had become a part of ophthalmic surgery. He tells us about refraction with the ophthalmoscope. He still used the inch system for numbering the focus of spectacle lenses. He speaks of a former belief that myopia was the normal condition of the human eye, and states that hyperopia had been "until quite recently almost entirely overlooked, at least its nature and results were not recognized. But once discovered and understood," he says, "it speedily revealed all its mysteries, and gave us the key to a number of phenomena. . . . Thus the source of asthenopia and of strabismus convergens was found in this anomaly."

Donders's preliminary estimate of the amount of myopic correction required was made by placing in the hand of the patient a book with small type, with which the patient was to indicate his farthest point of distinct vision. The patient was then to remove the book a little farther until the letters were rather less distinct. But Donders warns that "experience has taught me that we cannot be too cautious, for with good accommodation the action of too strong glasses is easily enough overcome. . . ."

We find in Donders several evidences of a prejudice against what the author calls "complete neutralization of myopia," in other words its complete correction. This is hardly surprising when we remember that probably most of the myopic patients had uncorrected astigmatism which easily became a source of eyestrain. Thus we are told that in certain cases the use of glasses is dangerous "and must be discontinued, so soon as it appears that the myopia is particularly progressive." Again, "in very slight degrees, from 1/60 to 1/18" [that is, from about 2/3 to 2.25 diopters] "we may leave the myope to himself." Further, "in the higher degrees, from 1/5" [that is, 8 diopters] "upwards, perfect neutralization is not pleasant for close work because . . . the images become too small." In such cases Donders would correct 3.25 to 2.50D., wearing for distant vision a lorgnette held before the spectacles. He remarks that the idea that there is anything injurious in this combination is an unfounded prejudice.

Even today in the United States it is still customary with some ophthalmologists to undercorrect myopia in the fear of throwing an excessive strain upon the patient's accommodation, and I believe I am right in saying that this tendency is carried much further in most European countries than in our own.

In the study of hyperopia, Donders, like many modern workers, was much disconcerted by the problem of latent hyperopia. He says: "In my first investigations respecting H, I encountered the difficulty of accurately determining the degree of this anomaly . . . I assumed that hypermetropic eyes, obliged to put their power of accommodation upon the stretch in order to see remote objects,

sometimes involuntarily to a certain degree kept up the tension, even when the proper glasses rendered this not only superfluous, but undesirable for accurate vision. Therefore, from the strongest glasses, with which the eye had, at different trials, still seen accurately at a distance, the degree of H was reduced. This should, as I supposed, completely neutralize the H. But when shortly afterwards, still stronger glasses were sometimes found adapted to the same persons, I discovered my error, and comprehended that those first given had not completely neutralized the H, and that in using them the accommodation to a certain degree continued in operation." Thus Donders was led to study the situation under atropine, and to his surprise found that not infrequently the greater part of the H had been suppressed. This led to the discovery that moderate degrees of H might be wholly suppressed, especially in cases of asthenopia and strabismus.

In this connection two comments seem to be called for. In the first place the examination for hyperopia, in Donders's days, must have been complicated by the fact that Snellen's recently introduced form of letter chart had not yet been generally adopted, and that it was still a very usual custom to measure the patient's far point by varying the distance of test letters from the patient, instead of depending upon variations in size of letters read at a fixed distance. The second comment is that in the earlier literature I have been unable to find any reference to the fogging method, and especially to bilateral fogging, by means of which it is now possible in most cases to uncover approximately the whole hyperopic error before using cycloplegia.

As regards the former observation, it is peculiarly interesting to note that the custom of three quarters of a century ago is persisted in by one of our most useful and necessary public institutions, the United States Navy, which still measures the distance at which the patient or candidate can recognize certain letters or signs, instead of having him read progressively smaller letters on a Snellen chart at a fixed and remote distance. It is true that the visual standards in the Navy lessen the harmfulness of this antiquated method, which in ordinary practice would have the substantial disadvantage of ignoring the influence of uncorrected myopia upon the statements of visual acuity.

It was the remarkable practice of a number of writers before Donders to treat asthenopia by first prescribing convex lenses and then, after an interval in which the patient was denied the use of his accommodation in close work, to weaken the spectacles gradually, and at the same time to permit gradually increasing application to close work. We cannot but agree with Donders's skepticism as to the success of such a course of treatment. And it is no wonder that, as we have seen, Mackenzie admitted he found it his duty in many instances to declare the asthenopia incurable!

Thus, as to the three great factors in refraction work, we see that Donders's attitudes were as follows: In myopia he was generally averse to full correction. In hyperopia he had made some steps toward recognizing the need for full correction, so far as near work was concerned, but hesitated to ask the patient to wear his correction for distant vision. As regards astigmatism, he was still using methods of measurement which were primitive as compared with those available today, and he hardly recognized the necessity for correcting astigmatism of less than one diopter. Since amounts of astigmatism which we now regard as significant enter into the correction of most

cases of hyperopia and myopia, we can see that the great majority of patients suffering from visual defects correctable by glasses either were given inadequate correction or failed to obtain any.

Since about fifteen years elapsed between the publication of Donders's work in English by the New Sydenham Society and Jackson's entry into practical ophthalmology, it is obvious that a good many American professional men must have studied the problems of refraction before Jackson's light began to shine. Noteworthy among these are H. Derby,[4] of Boston, and the elder John Green,[6] of Saint Louis. The latter showed a very special interest in tests for astigmatism.

In 1867 Green published in the American Journal of the Medical Sciences an excellent paper entitled "Detection and measurement of astigmatism," with illustrations of three astigmatic dials of his own design. One of these had sixty radiating lines whose selection was aided by Roman numerals corresponding to the hours of the clock.

Jackson's important contributions to the art of refraction may be practically divided into two groups, the one dealing with the principles upon which refractive corrections were to be measured and prescribed, the other concerned with improvements in technique.

As regards principle, the Jackson of the early eighties naturally began at the stage of development which had been reached by teachers and colleagues, the most important of the former being Donders. But, as Jackson carried on the practice of ophthalmology in the clinic and in his private office, he tended to investigate for himself the principles laid down by others, and to discover where these principles were faulty or incomplete.

It is unfortunate that history cannot record the lively interchange of ideas and experiences which must have gone on between the ophthalmologists of those years, particularly in Philadelphia.

The basis of Jackson's attitude toward correction of myopia and hyperopia is expressed in several papers. One of these,[8] "The full correction of ametropia," was read in 1891 before the Section on Ophthalmology of the American Medical Association; the other,[9] "The full correction of myopia," in 1892 before the American Ophthalmological Society. We find Jackson's logical mind impressed by the fact that the emmetropic eye is generally thought of as the ideal eye, and that "when an ametropic eye suffers from strain, one of the most important things that can be done for it . . . is to give it the optical aids that will make the conditions under which it works more nearly approach those of the emmetropic eye."

The fact that many of his colleagues did not follow this logical train of thought to its legitimate results was attributed by Jackson to several reasons. The first was that the new conditions caused by the wearing of correcting lenses always required a period of adaptation, particularly as regards the act of binocular vision. But he argued that in the long run, and apart from certain exceptional conditions, this period of adaptation was likely to be less protracted and less annoying when the correction for ametropia was complete than when it was partial. He stated that with due cooperation on the part of the patient he had never seen a case of so-called ciliary spasm that did not yield, so as to allow of perfect distant vision with the total correction, within two months of constant wearing of the glasses, and only two such cases that did not yield within two weeks.

However, and here is a point with re-

gard to which the textbooks are still generally at fault, the Jackson of 1891 points out that "the best correction at 4 or 6 meters is not the correcting glass for the total H., but is an overcorrection of 1/4 or 1/6 D."; continuing: "I know of no treatise on this subject that takes this into account." The practical significance of this fact is, of course, that, using Jackson's words, "patients given a 0.25D. overcorrection will not become accustomed to it and see clearly at a distance in any length of time. This inaccuracy must be avoided if you are going to correct the total H." Other conditions to which Jackson then called attention as affecting the result are the aberration of the eye and the necessity for fully warning the patient in advance of the early difficulties he may experience.

As to myopia, the Jackson of 1891 was merely one of a number of ophthalmologists who had reached the conclusion that it was usually preferable to give full correction for myopia. One of his colleagues, George C. Harlan of Philadelphia, who discussed the subject in a separate paper,[7] speaks of being encouraged to bring up the topic by Jackson's "temerity" in dealing with so trite a subject; and this suggests the comment that Jackson never hesitated to bring up a subject which some might think trite, but in regard to which many misconceptions and superstitions still existed among the profession.

Harlan's paper recalled how at the International Congress in New York, in 1876, a member had inquired concerning the practice of his colleagues as to the constant correction of myopia, and that a youthful ophthalmologist had been heard to mutter contemptuously, "Why does he take the time of the Congress with that? Why don't he read his textbook?" And Harlan remarked that that was probably just what the inquirer had been doing, and that it was the unsatisfactory result of this investigation that led to the question!

Jackson asserted that, contrary to many previous statements, he and others had more recently convinced themselves that the power of accommodation was usually as great in myopes as in hyperopes of the same age. He also called attention to a fact too often overlooked, namely that undercorrection of myopia instead of avoiding eyestrain often induced it, because the undercorrected myopic patient is likely to look obliquely through his lenses in order to increase their effect, and by so doing creates an artificial astigmatism.

Many years later Jackson returned to the same subject in a lecture[10] delivered at the Philadelphia Polyclinic. He here condemns the assumption "that to leave uncorrected a part of the refractive error when prescribing will not seriously lessen the benefit. This assumption," he continues, "involves two errors. First, that all persons can overcome ametropia without feeling worse for it; and second, that the altered ametropia created by a partial correction will be as well tolerated as the same amount of ametropia arising during the development of the eye, and to which the patient has always been accustomed." In this paper Jackson recalls the case of a physician of robust physique, past fifty years of age, "who suffered from dizziness and nervous dyspepsia; and who was only relieved by the constant wearing of his correcting lenses:

R. + 0.37 ⌒ + 0.25 cy.
L. + 0.25 sph."

Jackson's studious and critical contributions to refractive technique dealt particularly with the relative value of the ophthalmometer, with the principles and practical employment of the shadow test,

and last but not least with the testing of amount and axis of astigmatism by means of the cross cylinder. In 1887 he described his refraction ophthalmoscope,[11] but, however convenient within certain limitations the design of this instrument was, the use of the ophthalmoscope for refracting seems never to have established itself very firmly, although much favored by Loring.

Jackson's paper[12] on "The value of the ophthalmometer in practical refraction work," read before the American Ophthalmological Society in 1894, emphasized the fact that this apparatus measured only the corneal astigmatism, and he presented a statistical analysis to show that in three fourths of the cases corneal did not correspond to total astigmatism, that in almost one half of the cases the ophthalmometer was misleading as to the meridians of the total astigmatism, that determination of the direction of the astigmatism with the ophthalmometer was especially apt to be uncertain where the amount of the astigmatism was less than 0.50D., and that as a means of approximating the probable amount and meridians of total astigmatism it was greatly inferior to skiascopy among objective methods, and distinctly inferior to various subjective tests.

Jackson's detailed study of the shadow test,[13] first published in 1895, is one of the best productions of American ophthalmic literature. He had published two important articles on the subject in 1885 and 1886, the former in the American Journal of the Medical Sciences, the latter in the Journal of the American Medical Association. The shadow test, first described by Cuignet in 1875, had gradually come into use in France and England. But Jackson acknowledged in 1885 that he had been able to find only a single brief and inadequate description of it that had been published on this side of the Atlantic.

Most advocates of the method had recommended its use with the concave mirror, the concave mirror of the ophthalmoscope being usually employed. Jackson pointed out the distinct disadvantages of the concave and recommended the plane mirror, particularly with a small source of light. Loring had apparently dismissed the method "as of no practical importance."

As already indicated, the cross-cylinder combination referred to earlier in this address as having been devised by the English physicist Stokes, and later modified by Dennett and others, was a rather cumbersome contrivance whose purpose was to make a rapid variation in the amount of cylindrical lens held before the eye.

In 1887 Jackson read[14] before the Amerian Ophthalmological Society a paper describing "a trial set of small lenses and a modified trial-frame." This trial set employed planospherical and planocylindrical lenses of 1-inch diameter. In the course of the paper, Jackson included the following paragraph: "Astigmic lenses have been added. The astigmic lens, as described by Stokes, has with regard to one axis the action of a concave cylindrical lens; and in regard to the axis perpendicular to the former, the action of a concave cylindrical lens of equal refractive power. Such a lens is made by combining either convex or concave cylindricals, of equal refractive power, with axes perpendicular; or a spherical of one kind with a cylindrical of the other kind of twice the strength. The two used in this case are:

$$-0.25 \text{ sph.} \bigcirc + 0.50 \text{ cy.},$$
$$\text{and } -0.50 \text{ sph.} \bigcirc + 1 \text{ cy.},$$

of which the former is most generally useful. For two years I have used such a lens to hold in front of the approximate

correction, to determine if a cylindrical lens or a modification of the cylindrical already chosen will improve it; and it is far more useful, and far more used, than any other one lens in my trial set."

He then went on to describe an illustrative case. His earlier technique seems to have been to revolve the axis of the cross cylinder over a semicircle, and I believe that the only handle possessed by the two cross cylinders mentioned was the sort of handle attached to every other lens in the trial case. No drawings were given in explanation of the lenses and the technique of their use.

E. E. Maddox of Bournemouth, England, gave the cross-cylinder test for amount of astigmatism enthusiastic mention in a volume[19] called "Golden Rules of refraction"; and Schneideman[20] of Philadelphia discussed the subject very briefly in 1900. But Jackson made little further reference to it in print until the appearance of a paper[15] read before the Colorado Ophthalmological Society in 1907, under the title "Astigmic lens (crossed cylinder) to determine amount and meridians of astigmia."

In that article Jackson gave his first printed account of the axis test with the cross cylinder, with the following introductory remark: "Especially strange does it seem to me that I employed such lenses for twenty years, to estimate the strength of the cylinder, without appreciating their great superiority for fixing the direction of the axis, although for several years I had occasionally employed them for this latter purpose." This article contained a couple of drawings to show the effect of crossing equal and like cylinders with their axes 45 degrees apart.

In my earlier years I had the distinct impression that both cross-cylinder tests, and especially that for the axis of astigmatism, were chiefly used by the relatively few who had had the benefit of direct personal demonstration by Jackson. It was this impression, and experience in teaching the test during the Summer Course in Ophthalmology which Jackson had initiated in connection with the Colorado Ophthalmological Society, which led me to present my photographic demonstration before the International Congress of Ophthalmology in Washington in 1922.

The papers I have mentioned seem to me the most significant of Jackson's writings regarding refraction. There were many others, chief of them perhaps one read before the American Ophthalmological Society in 1888, "Symmetrical aberration of the eye,"[16] that is, the variations in curvature which occur, not as between meridians, but from center to periphery. Jackson had at first called the condition "meridional astigmatism," but the expression was properly criticized by Burnett and the elder John Green as likely to lead to confusion. This condition, Jackson's paper points out, is extremely important in regard to the technique and reliability or otherwise of skiascopy, as to some of the differences between refraction without and with cycloplegia, and as to the patients in whom it seems absolutely impossible to secure definite and consistent results concerning refractive measurement.

I have been disposed to think that Jackson displayed rather scant appreciation of the value of the better sort of astigmatic dials, the technique of which has been so ably elaborated by Lancaster and others. I believe, however, that he did occasionally use such dials in his own office practice.

The philosophy of Jackson's teachings with regard to refraction was built upon his conception of the importance of refractive measurement in the life of the

citizen, upon the belief that emmetropia was the goal to be sought in prescribing the distant correction, and upon the need for the utmost possible precision in the work of the refracting ophthalmologist, both in the interest of the patient and in the interest of the profession. His well-known activities in the direction of standardization of education for ophthalmic practice have been reviewed elsewhere.[2]

He always placed his sense of duty as a teacher ahead of the demands of daily practice. He personified the thought that the value of a man's life does not lie in the extent of his financial accumulations but in the knowledge of work well done, of lessons well learned and handed on to others, in the richness of his experience and the sincerity of his purpose.

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References

[1] Airy, George A. On a peculiar defect of the eye and a mode of correcting it. Trans. Cambridge Philosophical Soc., 1827, v. 2, p. 267.

[2] Crisp, W. H. Edward Jackson, student and teacher. Amer. Jour. Ophth., 1943, v. 26, p. 1.

[3] Dennett, W. F. The Stokes lens for measuring astigmatism. Trans. Amer. Ophth. Soc., 1887, v. 4, p. 106.

[4] Derby, H. Four cases of astigmatism. Amer. Med. Times, 1863, v. 7, p. 277.

[5] Donders, F. C. On the anomalies and refraction of the eye. London, New Sydenham Society (trans. by W. D. Moore), 1864.

[6] Green, John. On the detection and measurement of astigmatism. Amer. Jour. Med. Sci., 1867, v. 53, p. 117.

[7] Harlan, G. C. Constant correction of high myopia. Trans. Amer. Ophth. Soc., 1892, v. 6, p. 373.

[8] Jackson, Edward. The full correction of ametropia. Trans., Sec. on Ophth., Amer. Med. Assoc., 1891, p. 133.

[9] ———. The full correction of myopia. Trans. Amer. Ophth. Soc., 1892, v. 6, p. 359.

[10] ———. Accuracy in the measurement of refraction. Annals of Ophth., 1909, v. 18, p. 703.

[11] ———. A refraction ophthalmoscope. Ophth. Rev., 1887, v. 6, p. 1.

[12] ———. Value of the ophthalmometer in practical refraction work. Trans. Amer. Ophth. Soc., 1894, v. 7, p. 177.

[13] ———. Skiascopy and its practical application to the study of refraction. Philadelphia, Edwards and Docker Co., 1895.

[14] ———. Trial set of small lenses, and a modified trial-frame. Trans. Amer. Ophth. Soc., 1887, v. 4, p. 595.

[15] ———. Astigmic lens (crossed cylinder) to determine amount and principal meridians of astigmia. Ophth. Rec., 1907, v. 16, p. 378.

[16] ———. Symmetrical aberration of the eye. Trans. Amer. Ophth. Soc., 1888, v. 5, p. 141.

[17] Lawrence, William. A treatise on the diseases of the eye. Ed. 1, London, 1833; Ed. 2, London, 1840; Amer. Ed. 4, Philadelphia (edited by Isaac Hays, with additions), Blanchard and Lea, 1854.

[18] Mackenzie, William. A practical treatise on the diseases of the eye. Ed. 4, Philadelphia, Blanchard and Lea, 1855.

[19] Maddox, E. E. Golden rules of refraction. London, J. Wright and Co., 1902.

[20] Schneideman, T. B. The "crossed cylinder" in the determination of the refraction. Ophth. Rec., 1900, v. 9, pp. 169-172.

[21] Stokes, G. G. On the mode of measuring the astigmatism of a defective eye. Rept. Brit. Assoc. Advancement of Science, 1849, p. 10.

[22] Young, Thomas. On the mechanism of the eye. Philosophical Trans. Royal Soc., 1801, p. 23.

MYASTHENIA GRAVIS AND ITS OCULAR SIGNS: A REVIEW*

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The primary purpose of this paper is to evaluate our present state of knowledge regarding the ocular signs of myasthenia gravis. However, it is quite impossible to appreciate the ocular symptomatology without having a general knowledge of the disease and of its treatment, for this is one disease in which diagnosis and treatment are largely dependent upon the use of a single drug, prostigmine.

I. GENERAL REVIEW

Pathology. Since Weigert's original description of collections of lymphoid cells in the muscles and changes in the thymus, relatively little has been added to our knowledge of the pathology (figs. 1, 2, 3, 4).

Collections of lymphoid cells in the muscles or the absence of such cells does not indicate the severity of the affection. Buzzard termed these cell accumulations "lymphorrhages," and this term has come into general use. We have observed cases in which lymphorrhages were numerous and others in which they occurred in some sections of the muscles but not in others. It seems altogether likely that in any case of myasthenia gravis if a sufficient number of sections are examined, some of these cell nests may be found between the muscle fibers and around the blood vessels. In addition they may be found in the heart, liver, endocrine glands, salivary glands, and lungs (Wilson). According to Rottino and others myocarditis may be part of the pathology of myasthenia gravis. Their case exhibited areas of necrosis with secondary inflammatory changes in the heart, a finding described as entirely unlike lymphoid-cell infiltration.

Myasthenic muscles may undergo slight changes in the increase of sarcolemma nuclei, fatty infiltration, hyaloid appearance, or, according to Wilson, the muscles may become small and pale. Whether or not structural changes amounting to complete atrophy occur is a point on which there is not general agreement, but if so pronounced a change does occur, it might well be observed in the ocular muscles.

As regards the thymus in myasthenia gravis, it has been known for a long time that thymus tumor may be associated with the disease, or that there may be hypertrophy of the thymus gland. Thus, Bell, in 56 autopsied cases, found that the gland was hypertrophied in 17 and that tumor was present in 10 instances. From such reports it was reasonable to assume that thymus changes were significant only when tumor or hypertrophy of the gland was present. Recent observations by Blackman and by Sloan seem to establish as constant, changes in the thymus even when there is pronounced and normal involution of the gland. These changes consist of an infiltration of the medulla with lymphocytes and an increase in the relative width of the cortex, which becomes packed with lymphoid cells. The differentiation between the cortex and the medulla of the gland is lost. Lymphoid

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This paper has been based on case reports and these and parts of the text which have been deleted may be found in the Transactions of the American Ophthalmological Society of 1943.

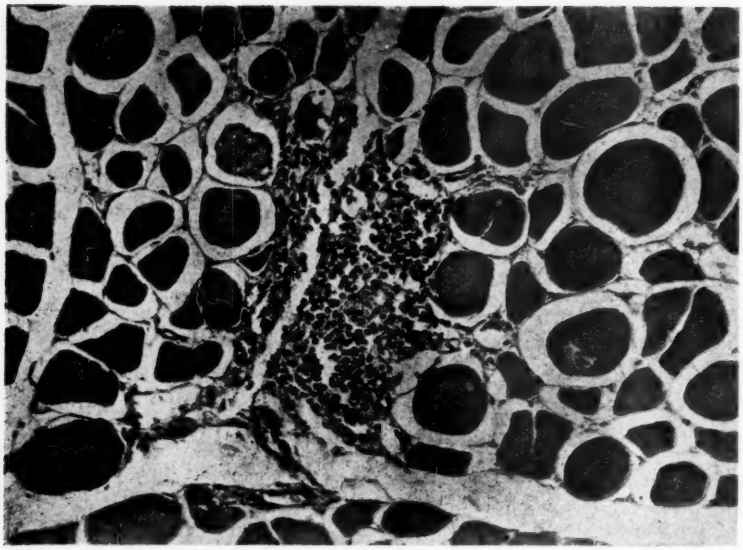

Fig. 1 (Walsh). Section of muscle showing collection of lymphocytes (Aut. 17768).

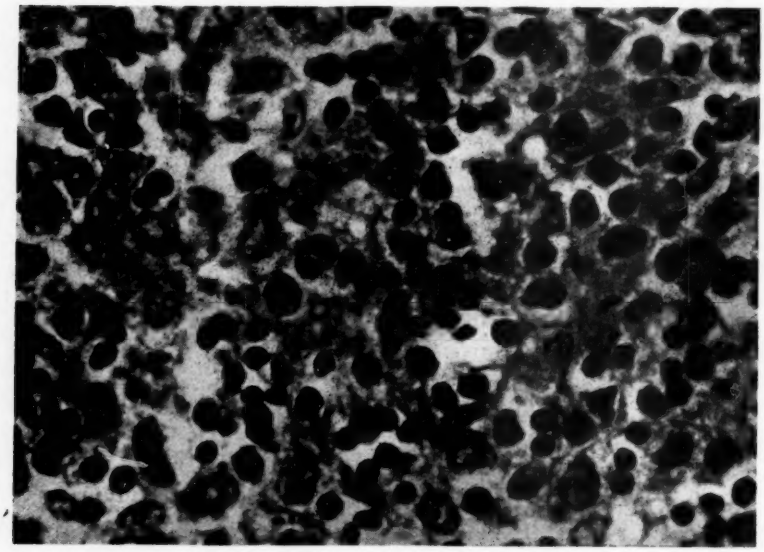

Fig. 2 (Walsh). Thymus tumor (high power). The section shows cells of two types: (1) smaller lymphocytes; (2) sheets of large epithelial cells. In general the proportions of these cells vary. The division into lobules separated by fibrous septa is not shown (Aut. 17768).

follicles with germinal centers are present in the medulla.

Sloan examined the thymus in cases of Addison's disease, acromegaly, and hyperthyroidism. In three of seven cases of Addison's disease, and in two of five cases of acromegaly, the histologic picture was similar to that seen in myasthenia gravis. In 20 thymus glands removed from individuals with hyperthyroidism

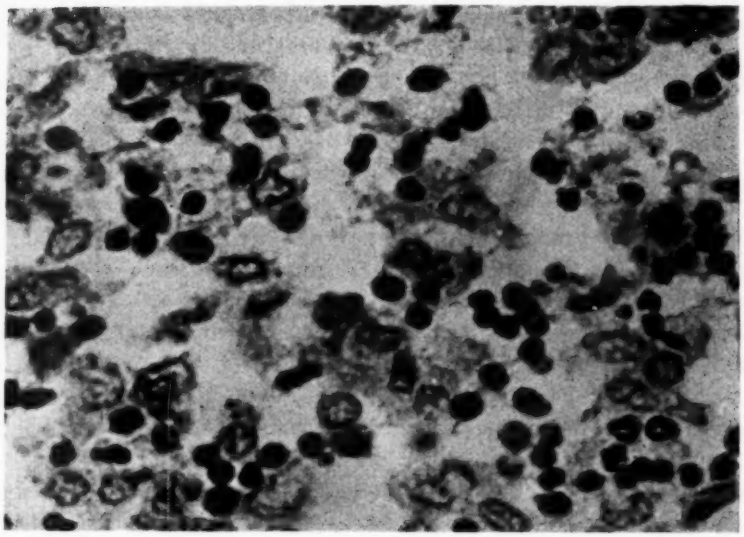

Fig. 3 (Walsh). A metastasis. Metastases are the same as the primary tumor, but often contain large channels filled with blood. Such channels are sometimes present to a less degree in primary tumor of the thymus. In this case the metastases were present in the visceral and parietal pleura of only one side.

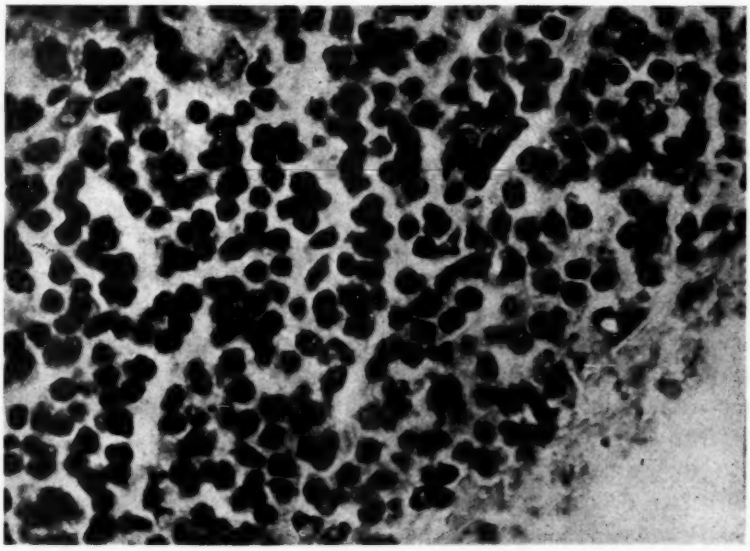

Fig. 4 (Walsh). Hyperplasia of the thymus. Note the pronounced hyperplasia of the cortex and the presence of many germinal centers.

there was lack of involution in 18 cases, and in the remaining five the changes were similar to those seen in myasthenia gravis.

In the central nervous system, in a great majority of cases, there is no involvement. McAlpine has described slight lymphocytosis in the brain stem, with perivascular infiltration and hemorrhages into the gray matter. He suggested that

these findings pointed to an occasional relationship between myasthenia gravis and epidemic encephalitis.

Occurrence. That myasthenia gravis is not a rare disease is evidenced by the number of cases which form the basis for this report. Before prostigmine became available, the diagnosis was frequently missed. Thus Viets remarked that in the Massachusetts General Hospital up to 1935 the diagnosis of myasthenia gravis was made about once a year, whereas from 1934 to 1941, 84 cases were so diagnosed. Our experience in the Johns Hopkins Hospital has been similar.

The sexes are about equally affected. In the series reported here there were 27 males and 36 females, and of these, 50 were white and 13 were colored. There were 22 white males and 28 white females, 5 colored males and 8 colored females. As regards the age incidence, the earliest age of onset was 11 months and the oldest age at onset of the disease was 75 years. The occurrence according to decades was: 0 to 10 years, 5 cases; 10 to 20 years, 10 cases; 20 to 30 years, 13 cases; 20 to 40 years, 19 cases; 40 to 50 years, 5 cases; 50 to 60 years, 7 cases; 60 to 70 years, 3 cases; 70 to 80 years, 1 case.

Heredity rarely appears to play a role, and no example was recorded among our cases. Noyes has reported the affection in a father and two daughters, Marinesco in two sisters, Hart in two siblings, and Rothbart in four brothers of a family.

The occurrence of myasthenia gravis in infancy and early childhood has always been questioned (by Kinnier Wilson among others). Consequently the observation of five cases in children below 10 years of age merits particular attention. Four of these five cases were in Negro children under six years of age. It is interesting to note that the affection may begin at as early an age as 11 months. Booth (1908) recorded a case at 23 months, and Kawaichi and Ito (1942) one at 21 months. It seems remarkable that it may begin at the age of 75 years, as in Case 61, where the diagnosis was established when the patient was 82 years old.

Contributing factors. It is impossible completely to evaluate exciting or contributing factors, since we do not know the etiology of the disease. There can be no doubt regarding the frequency with which the affection first manifests itself after a respiratory infection, since exacerbations are commonly observed as the result of such infections. The onset may be influenced by normal labor; its course may be affected by pregnancy, usually favorably (Viets and others), but not always so. Myasthenia gravis does not interfere with normal labor (Laurent). We have observed the development of myasthenia after ptomaine poisoning, after severe dog bites, and in association with urticaria.

In a great majority of cases there does not seem to be any exciting or contributing factor.

Associated conditions. Hysteria or emotional outbursts have been mentioned in several cases that have come under our observation. We have seen it in patients who exhibited signs of hyperthyroidism, in another patient who exhibited exophthalmos in the absence of signs of hyperthyroidism, and in association with diabetes. In one case there was evidence of the previous existence of anterior poliomyelitis or of some other disorder responsible for the smallness of one limb.

Curschmann reviewed particularly the possible role of the ductless glands in the production of myasthenia gravis, and concluded that in all probability endocrine disturbances were incidental rather than causative. He included congenital defects occurring in myasthenics, and observed it in two cases of aplasia of the female

genitals. He referred to the possible relationship of hyperthyroidism to myasthenia gravis, and was unable to obtain a myasthenic reaction in very severe cases of hyperthyroidism. Curschmann remarked that Marinesco had described hyperplasia of the hypophysis, and Tilney reported adenoma of the hypophysis in cases of myasthenia gravis.

Etiology. The nature of the fundamental disturbances responsible for myasthenia gravis is not known. All the available evidence, both clinical and experimental, points to the defect being in the muscles, and to the neuromuscular junction as the site of the disturbance. The evidence is necessarily incomplete and selective, since the literature is enormous and contains conflicting reports and complicated hypotheses.

Probably the earliest, and certainly one of the most productive, discoveries was made by Claude Bernard in 1857, when he found that mild curare poisoning will block impulses passing from nerve to muscle when both are capable of functioning. Because Walker recognized a similarity between paralyses of mild curare poisoning and those of myasthenia gravis, eserine was used in the treatment of myasthenia gravis, since it was known to be a decurarizing agent.

Recently acquired knowledge which has an important bearing on the problem concerns the chemical transmission of nerve impulses (Dale, Cannon, and Rosenblueth among others). This work requires only brief mention here. It has been established that in the autonomic system there are chemical transmitter substances, acetylcholine and sympathin. It has been assumed that acetylcholine is the transmitter substance responsible for the contraction of skeletal muscle, and this has been substantiated, in part at least, by the finding of acetylcholine in eserinized perfusion fluid from skeletal muscles when the motor nerve has been stimulated (Dale and Feldberg). As Dale has remarked, if acetylcholine is the chemical mediator which acts as a direct excitor of skeletal muscle fibers, it would have to appear with flashlike suddenness when an impulse reaches the motor nerve endings; then it would have to disappear within the brief span of the refractory period. It seems proved that eserine has a protective influence on acetylcholine through rapidly breaking down cholinesterases which hydrolize acetylcholine. Prostigmine, a substance closely related to eserine, has been found to be more effective than the latter in the treatment of myasthenia gravis. However, as regards the action of eserine, it has not been established that it acts entirely by attacking the cholinesterases, and it has been found that it is capable of stimulating motor nerve endings; it has also been determined that cholinesterases are normal in myasthenia gravis (Jones and Stadie).

To continue with the evidence which seems to point to the causal factor of myasthenia gravis being associated with abnormality at the neuromuscular junction, there may now be considered the clinical effects of prostigmine, acetylcholine, and other substances in normal individuals and in those suffering from myasthenia gravis.

When injected into the brachial artery of normal individuals in amounts of 0.5 to 1.5 mg., prostigmine produces: (1) a profound paresis of the muscles in the injected extremity (a band is placed about the arm in order to make the injection); (2) fasciculations (twitchings, fibrillations) of the muscle fibers in the extremity and similar but less pronounced twitchings elsewhere after the tourniquet has been removed. Prostigmine similarly injected into the brachial artery or elsewhere in a person suffering from myasthenia gravis gives precisely opposite re-

sults; namely, (1) partial or complete return of motor power; (2) no fasciculations.

Acetylcholine when injected intra-arterially in amounts of 20 to 40 mg. in normal individuals produces transient weakness of the extremity. If injected into an individual with myasthenia gravis, it produces a sudden contraction of the injected muscles.

Quinine, a curarizing agent, when given to normal individuals, produces no change in muscle response. If given to an individual suffering from myasthenia gravis, there is a pronounced increase in the weakness of the affected muscles (Harvey and Whitehill). An exception to this generalization may have been observed in case 12, where only the ocular muscles were involved. This case has possible significance from the standpoint of myasthenia gravis in some instances affecting only the ocular muscles. It is further considered in part II.

Other substances which are said to have a decurarizing effect are potassium chloride, guanidine, and calcium chloride. The administration of these substances to individuals suffering from myasthenia gravis does not produce detectable changes (Harvey and Whitehill).

Much experimental work has been done in recording the effects of stimulation of muscles. The electromyograms of normal individuals have been compared with those of individuals suffering from myasthenia gravis both before and after the administration of various drugs.

In normal muscles, Cobb and his collaborators confirmed previous work showing that the frequency of the primary waves during contraction diminished from 40 to 60 per second, but that the amplitude increased; and that in myasthenic muscles the frequency did not diminish, but the amplitude was smaller at the beginning than in normal muscles and rapidly diminished. These investigators observed that myasthenic muscle loses its contractile power before the onset of fatigue. Lindsley found that after intramuscular injection of prostigmine the myographic curves became practically normal. Harvey and Masland noted that the action potential recorded from the muscle of an individual suffering from myasthenia gravis was the same as that obtained from a normal individual when a single stimulus was applied. When responses to paired stimuli were compared, it became apparent that the response to the second stimulation was often smaller than that to the first, whereas in normal individuals there was no such difference. When the nerve was stimulated at low frequencies (50 per second or less), the muscle action potentials showed a rapid decline in voltage during the first few responses and then continued at lower levels of response. However, in normal individuals the muscle potentials showed little change.

From figure 5 it may be seen that following the administration of prostigmine the muscle action potentials became approximately normal. Harvey and Masland found increased abnormalities in myasthenics after the administration of quinine, but discovered that potassium chloride, guanidine, calcium chloride, and vitamin B_6 did not influence the electromyograms of individuals suffering from myasthenia gravis.

Harvey, Lilienthal, and Talbot studied five patients who had been subjected to thymectomy for the treatment of myasthenia gravis. They observed fasciculations in the muscles of three of these patients after the intra-arterial injection of prostigmine, and all three developed local paresis just as occurs in normal individuals. In these patients, all of whom had been favorably influenced by the operation, electromyograms showed that a large

number of muscle fibers responded and that there was greater efficiency in the transmission of pairs and trains of maximal motor-nerve stimuli.

Largely on the basis of the observations just mentioned, Harvey, Lilienthal, and Talbot concluded that in myasthenia gravis there is a deficiency of acetylcholine at the neuromuscular junction. This, in their opinion, accounts for the characteristic changes which they found in electromyograms. Their arguments were set forth as follows: (1) Prostigmine has a protective influence upon acetylcholine. (2) In normal individuals the injection of prostigmine intra-arterially produces local paralysis, and a similar result occurs from the injection of acetylcholine. Since precisely opposite results are obtained from the same procedures in patients with myasthenia gravis, it seems to follow that there is an insufficient amount of acetylcholine to provide for a depressant action. (Case 3 exemplifies such an unfavorable influence from the injection of prostigmine in an individual with myasthenia gravis. In this case large doses produced general toxic effects but increased the range of the ocular movements which had not been influenced by average doses.) (3) Finally, Harvey and his collaborators drew upon Cannon's theory of sensitization to a transmitter substance and assumed that if less acetylcholine is available, the threshold of the muscle for this substance is lowered.

The conclusions of Harvey and his collaborators seem to fit reasonably the facts so far as we know them, but they are, in part at least, based upon hypotheses which have not been completely verified. Many problems require more convincing proof than that available from the translation of electromyograms. It has previously been stated that there is some proof that acetylcholine is the transmitter substance responsible for the mediation of motor-nerve impulses to skeletal muscles. However, other mechanisms may play a part in the transmission of such impulses. It has been observed that the intravenous injection of acetylcholine may produce slow tonic contractions of skeletal muscle (Bard), and it was maintained by Duke-Elder and Duke-Elder that there was likely to be selective involvement of the muscles attached to the eyeballs. This is difficult to understand if the skeletal muscles normally contract as the result of the flashlike appearance of acetylcholine, as suggested by Dale.

Furthermore, if the extraocular muscles are as sensitive to acetylcholine as Duke-Elder's observations imply, it is difficult to understand why these muscles, with the exception of the levator palpebrae, are particularly resistant to prostigmine in individuals suffering from myasthenia gravis.

General symptomatology

Myasthenia gravis is characterized by fatigability and weakness of the muscles. It is difficult, if not impossible, to prove that fatigability precedes weakness, but it seems probable that it does. The diagnosis rests essentially upon the demonstration of fatigability. Usually this is readily accomplished in individuals suffering from myasthenia gravis by repeated opening and closing of the eyes or mouth, counting aloud, opening and closing the hand, raising the leg, or other similar movements intended to tire the affected muscles. As a rule, the diagnosis is made easily, but in some cases it may be difficult to make.

Ocular symptoms and signs. In all cases in this series there were ocular symptoms or signs, and these were usually the earliest manifestations of the affection.

Diplopia is frequently the earliest symptom of the disease. It may be present where there is no visible evidence of

limitation of ocular movements, or it may be associated with ptosis or with muscle paresis. Ptosis, often bilateral, occurs frequently. Characteristically, it is absent or minimal in the morning, becoming more pronounced as the patient becomes fatigued. Limitation of ocular movements varies within wide limits, and often affects both eyes, but may affect only one eye or even a single muscle. Inability to close the eyelids tightly is frequently present; it may be associated with ptosis and with limitation of ocular movements. The ability to converge the eyes is often lost. In our experience, the pupils are not affected in myasthenia gravis. The visual acuity and visual fields are not altered. It seems highly questionable whether accommodation deficits can properly be attributed to myasthenia gravis.

"Bulbar" signs. Early writers referred to myasthenia gravis as asthenic bulbar paralysis (Strümpell) because of the following signs: Facial weakness, usually bilateral, is commonly present and was observed in 23 cases. This weakness lends a flat appearance to the face, and a smile seems more like a snarl, since the retractor muscles at the corners of the mouth are more severely affected than the elevators. Facial weakness is often associated with inability to close the eyelids tightly and with ptosis and paralyses of the extraocular muscles.

Weakness of the jaw muscles, which was present in 10 cases, accounts for the inability to chew food properly, and often develops toward the end of a meal. In severe cases the lower jaw sags and can be elevated only by the aid of the hands. We observed a myasthenic who placed a rubber band around his head and jaw to keep the latter in position.

Weakness of the soft palate and pharynx produces difficulty or inability to swallow properly. In severe cases regurgitation of fluids through the nose occurs (10 cases). Palatal weakness lends a nasal quality to the voice, which is readily demonstrated by asking the patient to count aloud. Weakness of the tongue and larynx adds to the difficulty in speaking, and if the laryngeal muscles are severely affected there is aphonia.

Weakness of the intercostal muscles and diaphragm is responsible for dyspnea and varies according to the amount of rest the myasthenic has had. In severe cases periods of respiratory distress come on, at first after tiring, later appearing spontaneously and without apparent cause. Occasionally respiratory distress is apoplectic in its onset, and respiratory failure is a common cause of death in myasthenia gravis.

Other signs. Weakness of the muscles of the legs and arms may be the earliest evidence of the disease, and in our experience this weakness of the legs is fairly often an early manifestation of myasthenia gravis. The hands and arms may become weak or powerless after use; such weakness was observed as an early sign in case 63. There may be complaints of weakness only in one arm, or only of the fingers. Women often complain of tiring of the arms when combing their hair. The weakness may appear to be bilaterally selective, as shown in case 33, in which the first symptom was weakness of the ring and little fingers of both hands. Weakness of the muscles of the neck is a frequent sign. On becoming fatigued the patient is unable to hold the head erect and must support it with the hands.

Other body muscles, such as those of the spine and abdomen, may be involved. In such cases the patient is unable to sit in a chair for more than a few minutes, and in the few bedridden individuals whom we have observed there have invariably been many evidences of the disease.

Muscular wasting is not commonly

present, and in severe cases, according to our experience, it is not pronounced. Whether profound myasthenia gravis may result in permanent paralysis is open to question, but Collier has maintained that this does occur. Our cases do not contain a single example of permanent and complete paralysis of muscles, unless possibly in the instances of external ophthalmoplegia. We have not observed fibrillations in the muscles of myasthenics save when there has been an overdosage with prostigmine. Wilson has described changes in the tongue: "A triple shallow longitudinal furrow is frequently found on the tongue, one running along the raphe and one on each side, midway between the former and the lateral edge."

Subjective sensory changes are described occasionally, but are probably incidental. Pain in the region of the eye led to an erroneous diagnosis of aneurysm. In case 44, pain in the eye seemed the only indication for performing drainage of the maxillary sinus. In this case there was also pain in the legs and arms. Numbness and a sensation of "pins and needles" in the arm were described in one patient.

Tendon jerks were found to be normal in the cases reported here. Tiring of the knee-jerk is said to occur in myasthenia gravis, but a brief rest results in its reappearance (Wilson).

Course. Myasthenia gravis is essentially a chronic disease, characterized by remissions, which usually are partial, and by exacerbations. In this series, among 63 patients, there were 9 deaths during an 11-year period. Since, however the cases were being collected during this period, these figures have no statistical value. The longest duration of the disease in a nonfatal case was 27 years, and it is noteworthy that this patient suffered at first only from weakness of the ocular muscles. The shortest course was 3½ months.

Respiratory infections are often associated with exacerbations, and such cases have been observed. Pregnancy frequently has a favorable influence, and remissions commonly occur and persist for several months after delivery (Viets and others). It is of some interest that normal labor appeared to precipitate the disease in case 53. In case 54 an abortion was performed during the first trimester of pregnancy.

In fatal cases, respiratory paralysis is the usual cause of death. The injection of prostigmine is quite often a lifesaving procedure. Grinker mentioned cardiac failure as a cause of death in myasthenia gravis, and in this regard the report of Rottino and his co-workers is of interest.

Clinical tests. The production of fatigue by repeated voluntary efforts has already been mentioned. Closing and opening the eyes may bring on ptosis, and movement of the eyes in various directions may produce limitation of ocular movements. Counting aloud brings out a nasal quality of the voice. The patient may be unable to drink a glass of water.

Apparatus such as the dynamometer may be used to record the strength of the hand-grasp. These tests, when repeated after the injection of prostigmine, point to an increased strength of the muscles.

Electric-response tests. The myasthenic reaction—Jolly's reaction—is not specific for myasthenia gravis since it occurs in other conditions, such as polyneuritis, extreme debility, in some cases of epidemic encephalitis, and in cases of brain tumor (Wilson). Furthermore, absence of the myasthenic reaction is occasionally observed in undoubted cases of myasthenia gravis.

The reaction consists of progressive loss of response to rapid stimuli ("faradic" current), whether constantly or intermittently applied. Usually the apparatus employed has 60 cycles per second (60 C.P.S.). Following such loss of re-

sponse a rest period of several minutes allows the response to reappear and again follow approximately the same course. When a muscle fails to respond to such stimulation, it may respond to voluntary effort, and, conversely, when it has failed to respond to voluntary effort, it may do so to electric stimulation.

Slow stimuli ("galvanic" current) also account for progressive loss of response in the muscles stimulated, but it has been found that complete abolition of response with this type of current is not so readily obtained as with the more rapid type.

Mention has been made of electromyograms.

Tests with drug substances. Prostigmine methylsulfate, when injected subcutaneously in doses of from 0.5 to 1.5 mg., produces pronounced improvement in the muscle power, usually within 5 minutes, but occasionally within 20 or 30 minutes. If more than 0.5 mg. is given, 0.5 mg. atropine should be added. Ptosis is invariably improved or abolished, and other weaknesses are diminished. The muscles attached to the globe are particularly resistant to prostigmine, and increase in the range of ocular movements cannot be anticipated, although sometimes it does occur. As a result of prostigmine administration abdominal cramps, diarrhea, and loss of control of the sphincters may occur in individuals who do not suffer from myasthenia gravis. An injection of atropine is sufficient to allay these symptoms. In myasthenics large amounts of prostigmine may produce cramps and diarrhea unless sufficient amounts of atropine are given.

It is noteworthy that in all, or almost all, cases in which a diagnostic dose of prostigmine has demonstrated fatigability of the muscles, there is a general sense of well-being and increased motor power after its use.

If it is impossible to establish the diagnosis on the basis of the history or by the use of prostigmine, quinine may be useful. In the adult one or two doses of 0.6 gm. will almost always increase the symptoms. Such a test occasionally precipitates acute respiratory embarrassment, and in such case an injection of prostigmine gives immediate and dramatic relief.

In case 12 quinidine was given to a patient who exhibited only ocular signs of myasthenia gravis, and since he did not show any evidence of further weaknesses, the diagnosis was questioned. It would seem that since this patient suffered only from severe ocular-muscle involvement, it was impossible to detect an increase in his signs if, indeed, they were increased.

Laboratory tests. These have little or no value either in establishing the diagnosis or in evaluating the progress of myasthenia gravis.

According to Williams and Dyke, creatinuria is a definite symptom of myasthenia gravis. Adams and Power were unable to find any abnormality in blood chemistry. These observers found pronounced creatinuria in 6 of 28 cases, and the extent of the creatinuria did not seem to bear any relationship to the severity of the disease. In almost all their cases the feeding of glycine increased the output of creatine in the urine. Adams, Power, and Boothby also found increased creatinuria after feeding glycine. Nevin found that the phosphorus-holding compounds of muscles in myasthenia gravis were normal, and he concluded that there is no abnormality of muscle metabolism.

Treatment

Prostigmine methylsulfate, from 0.5 to 1.5 mg. per hypodermic syringe, is used mainly in diagnosis, but is valuable also in emergencies, such as respiratory failure. The oral administration of prostigmine bromide is now generally accepted as the proper routine treatment. It is

available in 15-mg. tablets and is given in different amounts according to the severity of the case. It seems a good working rule to give it often in such small amounts as afford relief. In mild cases 15 mg. given three times daily may be sufficient, but in severe cases 150 to 180 mg. or more may be given in divided doses every three hours. In such cases it may be found advantageous to combine ephedrine, 0.25 gm., twice or oftener during the day. If considerable amounts of prostigmine are being used atropine is usually necessary to control abdominal cramps and diarrhea. Viets has written on this subject on the basis of a wide experience.

Mention of thymectomy has already been made. X-ray therapy applied to the thymus is said to have influenced some cases favorably.

We have not had experience in the use of synthetic adrenal cortical extract, as described by Moehlig.

Differential diagnosis

In the cases recorded here, mention is made of several conditions which were confused with myasthenia gravis. Since, in a majority of cases, the diagnosis of myasthenia gravis demands a correct analysis of ocular signs, it would necessarily follow that conditions regularly associated with ocular signs may be mistaken for myasthenia gravis or vice versa. Ocular signs occurring as the result of abnormal thyroid states may also characterize myasthenia gravis, and the latter and hyperthyroidism may coexist. Abnormalities in associated movements of the lids which have been shown to result from misdirection of regenerated fibers in the third nerve may also be observed in myasthenia gravis when there is no change in the nerves. A mistaken diagnosis of congenital aneurysm was made in case 17. It seems that infrequently in myasthenia gravis the involvement of muscles results in a picture almost like that seen when there is paresis of the third nerve, but in myasthenia gravis the pupillary responses remain intact. Since describing the ocular signs of intracranial aneurysm (Walsh and King), we have observed a case of aneurysm in which there was evidence of third-nerve involvement but absence of any change in the pupil. Such cases are undoubtedly rare, and consequently it seems sound to state that apparent third-nerve paralysis without pupillary change should always suggest the possibility of myasthenia gravis, whereas third-nerve paralysis associated with internal ophthalmoplegia is often due to aneurysm.

Myasthenia gravis may erroneously be diagnosed in the presence of muscular dystrophy which has involved the facial muscles, and in this regard case 63 is of interest.

An acute episode of respiratory failure as a result of myasthenia gravis may be confused with a similar occurrence in the bulbar type of poliomyelitis or encephalitis, in which instance the diagnosis can be established only by an injection of prostigmine. Such an episode in myasthenia gravis could be confused with acute hypoglycemia.

The occurrence of diplopia as an early symptom of myasthenia gravis suggests that, in differentiating it from disseminated sclerosis, confusion can arise. In some such instances the diagnosis must remain in doubt until further symptoms develop, or other features seen in disseminated sclerosis may serve to establish that diagnosis.

The ocular signs of myasthenia gravis require differentiation from those of external nuclear ophthalmoplegia and from recurrent ophthalmoplegia, which is most frequently caused by aneurysm. In these conditions there is no response to prostigmine.

In the peripheral types of myasthenia gravis confusion might arise with muscular dystrophies and atrophies. In myasthenia gravis there is an absence of wasting which distinguished the conditions mentioned, and, further, there is an absence of fibrillations of the muscle fibers which characterize muscular atrophies, and absence of the reaction of degeneration which is seen in spinal muscular atrophy.

Finally, myasthenia gravis has been described as being associated with the chronic stage of epidemic encephalitis. I have not seen such cases, but it seems probable that cases described as encephalitis with myasthenia gravis represent true myasthenia gravis.

Part II. The ocular signs

Material. This study is based on 63 proved cases of myasthenia gravis studied in the Johns Hopkins Hospital between 1932 and 1943. Approximately 25 percent (15 of 63) of these patients first sought advice from an ophthalmologist.

Most of the examinations were reasonably complete, and included mention of the lids, ocular movements, pupils, and visual acuity. The visual fields were charted in a minority of the cases and accommodation power was accurately measured in relatively few. A majority of these patients were observed by the present writer.

Frequency of ocular involvement. We did not observe a single patient in whom there was no evidence of ocular involvement. In a great majority of them ocular symptoms and signs were early, but in several cases there was a history of weakness elsewhere during prolonged periods before the ocular muscles were affected.

Purely "ocular" myasthenia gravis. In some instances myasthenia gravis seemingly affects only the ocular muscles during lengthy periods, but such localization does not preclude spread of the weakness, even after many years. Furthermore, in cases of "ocular" myasthenia gravis the injection of prostigmine invariably gives the patient a sense of well-being, even though the affection seems localized in the eye muscles. Cases 6 to 15, inclusive, represent what might be regarded as ocular myasthenia gravis. In one instance there was a history of onset some 13 years before the patient was examined by us. During that time there had been remissions and exacerbations which always affected the ocular muscles. Other writers have observed the affection to be restricted to the eye muscles for prolonged periods, and in this regard Gavey's patient is of particular interest, since he suffered from such an ocular affection for 25 years. One of our patients, after having suffered from recurrent diplopia and ptosis for 16 years, developed a spread of muscle weakness.

It would seem reasonable to test individuals suffering from what appears to be purely ocular myasthenia gravis with quinine. We have tested only one such individual, in whom there was no increase in signs. When the affection is generalized, the symptoms are increased.

Predominance of ocular involvements. The relative frequency and the early involvement of the ocular muscles do not require statistical confirmation. The predominance of the ocular-muscle participation in the syndrome can well be the basis of much speculation, particularly when the following considerations are taken into account. It has been shown that the extraocular muscles are finer than other voluntary muscles, and that they contain two types of fibers, one of which is thick and the other thin. These muscles contain a large amount of elastic tissue in the perimysium. Further, the complicated structure of the muscles receives an elaborate nervous supply, which is not simply

motor, from the third, fourth, and sixth nerves. There are other fibers which, according to Woollard, originate in the mesencephalic root of the fifth nerve and have a proprioceptive function. Also, as mentioned under the head of etiology, acetylcholine has a selective action in producing a slow tonic contraction of the normal extrinsic muscles of the eye (Duke-Elder). For some reason, in many cases paralyses of muscles attached to the eyeball are slightly, if at all, influenced by prostigmine. With these observations in mind, it would seem possible that ultimately the frequency of "ocular" myasthenia gravis may be worked out.

Ptosis. Ptosis of the lids of one or both eyes is almost always present at some time during the course of myasthenia gravis. There is rarely retraction of the lids, but in one instance we have observed retraction which was preceded by ptosis. When our patients were examined bilateral ptosis was present in 34 instances,

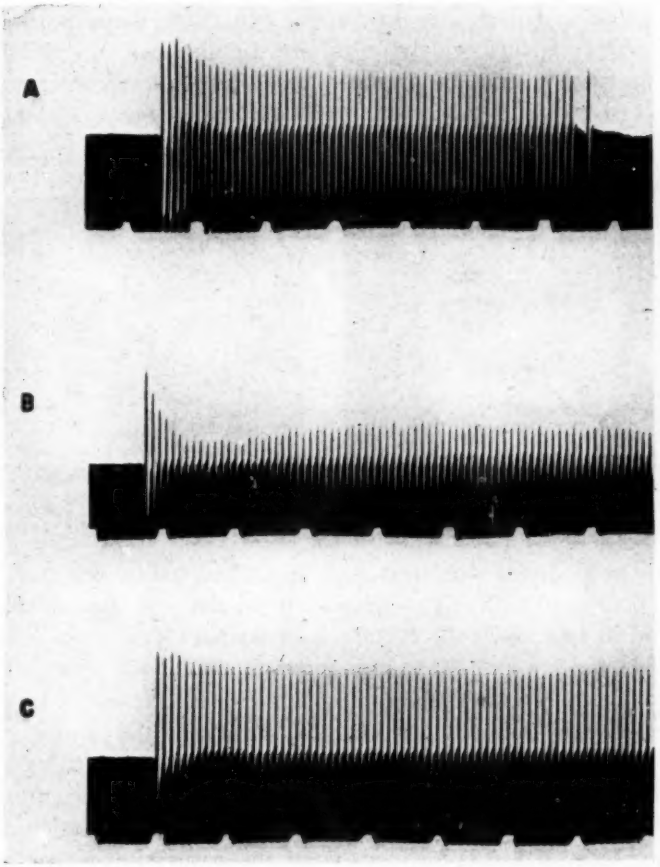

Fig. 5 (Walsh). Muscle action potentials during repetitive stimulation of the ulnar nerve in a patient with myasthenia gravis. (A) Initial tetanus after rest. (B) Second tetanus 10 seconds after the first. (C) Same as (B) 30 minutes after use of prostigmine. All nerve stimuli supramaximal. Time, 0.2 seconds. Initial potential, 6.0 millivolts (Harvey and Masland).

and unilateral ptosis, in 20. In two cases it was mentioned as being absent, and in seven cases it was not mentioned. Characteristically, ptosis is most pronounced after the patient has become tired, and consequently it may be absent or minimal in the mornings. In severe cases the lids may be opened widely only once or twice after the patient awakes from sleep. Ptosis on one side may be associated with pronounced weakness of the orbicularis oculi, and with other facial weaknesses, and in such cases the eyelids cannot be opened widely or closed tightly. This combination of weakness both in opening and in closing the eyes was observed frequently in the cases here described, and it has seemed that there is always some weakness of lid-closure when ptosis is present. Ptosis is frequently associated with limitation of extra-ocular movements in one or both eyes. Myasthenia gravis may, of course, occur in an individual with congenital ptosis. Courtis and Sitler described such a case.

It has been our experience that the injection of prostigmine methylsulfate, in amounts of from 1 to 3 c.c. of a 1:2,000 solution (ampules containing 0.5 to 1.5 mg. prostigmine) invariably produces improvement or disappearance of the ptosis and occasionally results in retraction of the upper lid (case 2, fig. 6). When more than one ampule is injected, there should routinely be included 0.5 mg. (1/100 gr.) atropine. If the ptosis has been more pronounced on one side, the lid on that side may be elevated less than its fellow of the opposite side (fig. 7). In many cases ptosis is relieved by prostigmine when the muscular palsies are affected scarcely, if at all.

Edema of the lids. This symptom has been observed by Klar, who considers local edema and generalized urticaria as prodromal symptoms in myasthenia gravis. We have observed edema of the lids as the earliest involvement in case 5, in which the ptosis remained when the edema disappeared. In case 45 there was a widespread maculopapular rash at the onset of the affection, and recurrence of the rash with exacerbation. The significance of these symptoms is not at all clear.

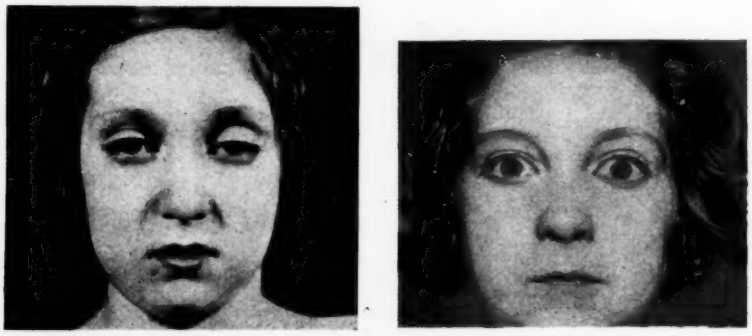

Fig. 6 (Walsh). Before and after injection of prostigmine (case 2).

Retraction of the lids. Retraction of the upper lids is observed infrequently in individuals who suffer from myasthenia gravis. In this series it was unilaterally present in two cases. In both instances retraction was associated with lid-lag. In case 11 retraction appeared and persisted after ptosis had previously chronically been present. Such a transformation from ptosis to retraction has been described by Collier. Buzzard observed bi-

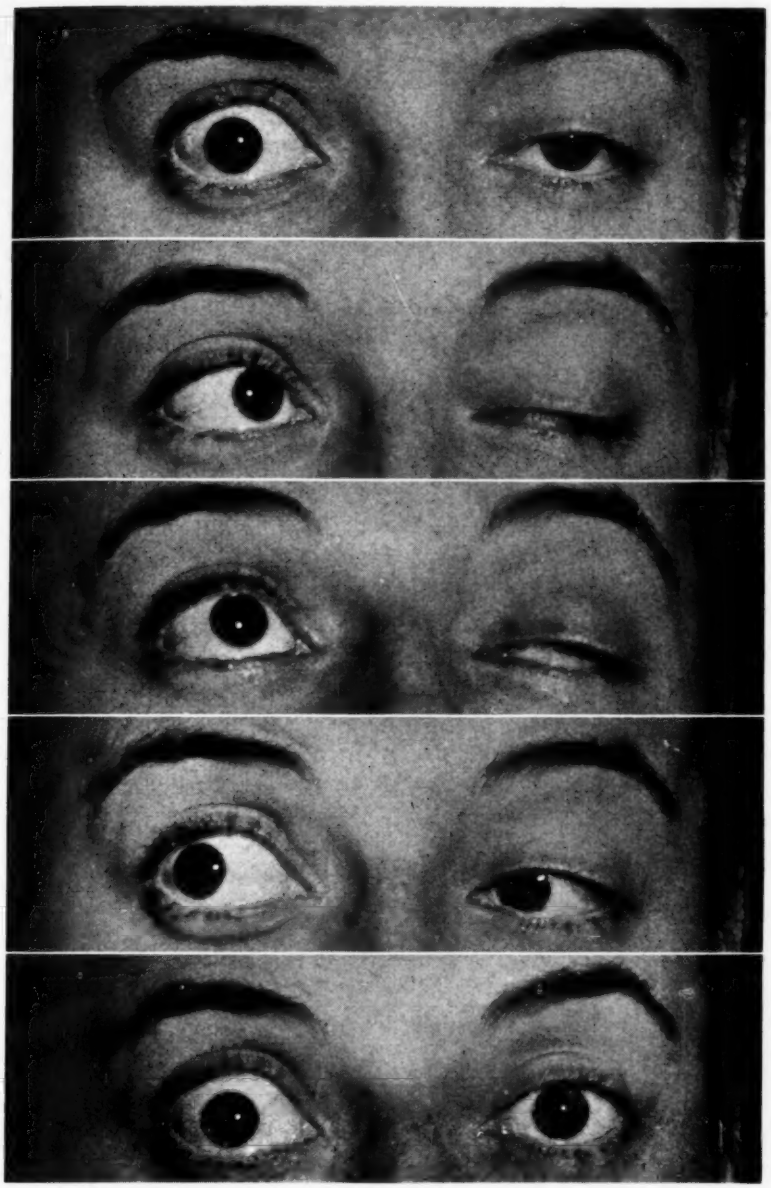

Fig. 7 (Walsh). M. J. F. (case 11). Note the staring appearance of right eye. There was "lid-lag" when the patient looked down. There is drooping of the left upper lid when the eye is abducted and slight elevation of the left lower lid when that eye is abducted. The lowest figure shows the appearance after a diagnostic injection of prostigmine.

lateral retraction of the upper lids as a transitory phenomenon in a patient who suffered from myasthenia gravis. There was retraction, which lasted for only a few minutes when the patient awakened, and then ptosis appeared and persisted. These observers regarded the retraction as evidence that the plain muscle fibers of the

lids are not involved in the myasthenic process.

The combination of ptosis in one eyelid and retraction of its fellow of the opposite side results in an unusual picture (fig. 7). The fact that retraction developed after there had previously been ptosis points to the abnormality being peripheral in myasthenia gravis.

An explanation for retraction of one or of both lids in myasthenia gravis is not readily available, but the phenomenon does stimulate speculation. It is interesting to compare figure 7 with figure 6. It may be observed that in case 2 the injection of prostigmine was responsible for the retraction of a previously ptosed lid; that is, it produced the same condition that was chronically present in the right eye in case 11. If it is acceptable that acetylcholine is the transmitter substance responsible for the contraction of skeletal muscle, and if it is further acceptable that the threshold of the muscle for this substance may be lowered, it would seem to follow that in case 11 the elevator muscle of the right upper lid had become exquisitely sensitive to acetylcholine. The lid-lag in case 11 and case 48 suggests activity of the plain muscle in the lids.

In unilateral cases, such as case 11, another explanation might be offered. If an extraocular muscle is paretic and the eyes are turned toward the field of action of that muscle, there is a secondary deviation of the sound eye. The retraction of the upper lid of the right eye in case 11 might represent a state of secondary deviation. However, if this were a true explanation of the anomaly, unilateral retraction of the lid would commonly be seen in myasthenia gravis. Further, bilateral retraction does occur.

Actually, retraction of one or both upper lids occurs under a variety of circumstances in which explanation is difficult. It may be observed in hyperthyroidism, and mention is made further on regarding the possible relationship between ocular signs in hyperthyroidism and in myasthenia gravis. It also is seen in association with lesions of the brain stem and posterior commissure (Collier), and it occasionally occurs as a transitory phenomenon in persons whose health seems excellent. A congenital variety has been described.

Abnormal associated movements of the upper eyelid. In two cases an interesting anomaly was observed in an associated movement of the upper eyelid. In case 11 (fig. 7), previously mentioned in association with retraction of the upper lid of the right eye, there was abnormal lowering of the upper lid of the left eye when that eye was carried into the abducted position. In case 44 (fig. 8), when the eyes were carried into the field of the paretic left external rectus muscle, there was anomalous elevation of the right upper lid.

Both phenomena are precisely similar to what has been described regarding the upper lid in cases of regeneration of the third nerve with misdirection of fibers (Bender; Ford; and Ford; Walsh and King). In cases of misdirection of fibers there is elevation of the upper lid when the affected eye is adducted; that is, when it is moved into the field of the internal rectus muscle, which is also innervated by the third nerve. In the instance of the eye being abducted, the upper lid is abnormally lowered, presumably because the eye is taken out of the field of action of the internal rectus. This is in conformity with Sherrington's law of reciprocal innervation, which is to the effect that contraction of an ocular muscle is associated with simultaneous relaxation of its opponent muscle. However, the upper-lid phenomena observed in cases of myasthenia gravis cannot be due to misdirection of nerve

fibers, since, so far as we are aware, there is no change in the nerves in myasthenia gravis. That the law of reciprocal innervation is still in effect when myasthenia gravis is present can scarcely be doubted, and in myasthenia the muscular involvements are such that abnormal lowering of the upper lid when the eye is in abduction is an anticipated result. The retraction of the upper lid in case 44 probably is dependent upon changed threshold of the ocular muscles for transmitter substance.

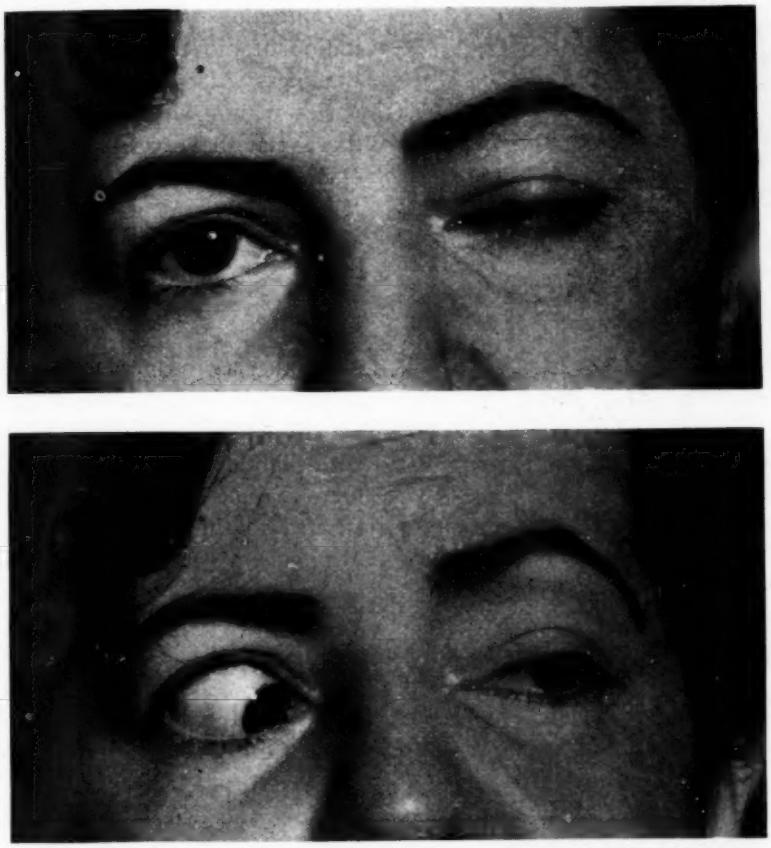

Fig. 8 (Walsh). Paresis of the left external rectus muscle and ptosis of the left upper lid. Note the abnormal widening of the palpebral fissure on the right when the eyes are directed to the left. The right eyebrow is considerably lower than the left.

Weakness of the orbicularis oculi and facial muscles. It has previously been stated that facial weakness, almost always bilateral, is frequently present in myasthenics. Wilbrand and Saenger found weakness of the orbicularis oculi in 25 of 45 individuals suffering from myasthenia gravis (Taylor, in Posey and Spiller). In our series, 16 cases showed bilateral facial weakness, and in all of these the orbicularis oculi was weak. As a result of this weakness, there is an inability to close the eyelids tightly. In only two cases was there apparent to the examiner only weakness of both orbicularis muscles. Ptosis in myasthenia gravis is often associated with weakness in closure of the eyelids, which is mani-

fest if looked for. Undoubtedly, in all cases in which there is ptosis there is also some degree of weakness of the orbicularis, a symptom that can be elicited by repeated efforts at tightly closing the

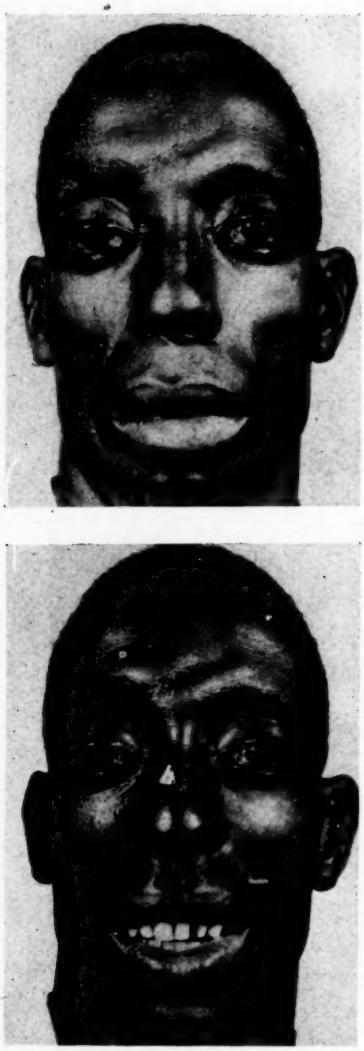

Fig. 9 (Walsh). Exposure keratitis in Negro suffering from myasthenia gravis (case 32).

eyelids. In one instance (case 32, fig. 9) we observed exposure keratitis.

In bilateral or unilateral incomplete facial-nerve paralysis efforts to close the eyelids almost invariably result in the occurrence of Bell's phenomenon (upturning of the eyes on efforts to close the eyelids against resistance). This was observed in two cases in which the facial weakness was that of myasthenia gravis. The reaction of degeneration (R.D.) is quite different from the myasthenic reaction.

Limitation of ocular movements. Limitation of movement of the eyes due to weakness of the extraocular muscles varies within wide limits. In mild cases there may be occasional diplopia when examination does not reveal limitation in range of movements of either eye. In such cases there is danger of the condition being considered "functional." The muscle-balance tests vary from time to time.

In other cases characterized by minimal ocular involvement there is diplopia, which appears regularly in association with slight degrees of ptosis. Occasionally there may be limitation of movement, restricted to the field of a single muscle. Minimal involvements of the extraocular muscles may persist for long periods. When cases of this nature are encountered, repeated efforts to move the eyes into various positions usually bring out a manifest limitation in the range of movements in one or more fields.

It has often been stated that inability to move the eyes upward is seen most often, that limitation or loss of convergence is next in frequency, and defect in downward movement is the least common defect in myasthenia gravis. This study neither supports nor refutes this generalization. It does show that limitation of movement of the eyes may be unilateral or bilateral and in any direction, and that sometimes there is a close resemblance to supranuclear paralysis of conjugate movement.

In quite a number of cases in this series there was pronounced limitation of the

extraocular movements, and in such cases there invariably was severe bilateral ptosis. These cases of myasthenic ophthalmoplegia are of particular interest for two reasons: First, the extraocular palsies exhibit a pronounced and characteristic resistance to improvement when prostigmine is used as a diagnostic or therapeutic agent. In our cases the ptosis invariably was lessened or abolished by the administration of a diagnostic injection of prostigmine. The paresis of the extraocular muscles invariably was improved slightly, if at all. Secondly, there is the possibility that in such cases of almost complete external ophthalmoplegia there may be a permanent structural change in the muscles which amounts to persistent and total paralysis.

As regards myasthenia gravis and involvement of ocular muscles of only one eye, the series contains several cases of interest. Such cases have been reported by Moore.

Cases of myasthenia gravis in which there appears to be paralysis of conjugate movements of the eyes are unusual, but we have observed two such cases.

Pupillary changes. It has often been stated that in myasthenia gravis the pupillary response to light may become sluggish (Wilson, Brain, Rea, among others). This has not been our experience. Furthermore, it would seem that there would be a tendency toward pupillary dilatation in individuals with severe myasthenia if the pupillary reaction tended to tire—and there is no such tendency so far as the author is aware.

Changes in accommodation. Rabinovitch and his co-workers demonstrated a rapid reduction in accommodation power by recession of the near point from 7 to 40 cm. in the right eye, and from 12 to 40 cm. in the left eye; according to retinoscopic examination, their patient exhibited a spasm of accommodation when the test was begun. The cases which have been used in this study cannot be considered as contributing to our knowledge regarding accommodation in myasthenia gravis.

The visual fields and visual acuity. There was no instance among the cases here reported of any change in visual acuity or in the visual fields.

Ocular signs common to thyroid states and myasthenia gravis. The ocular signs associated with thyroid states are generally well known. The same signs may be present in myasthenia gravis. Such signs, as exemplified in the writer's case reports, are: progressive exophthalmos, retraction of the upper lid with delay in down-following movement (lid-lag), difficult or absent convergence, and muscle palsies, which are particularly likely to be pronounced in so-called exophthalmic ophthalmoplegia.

Examination of the muscles in exophthalmic ophthalmoplegia and in some instances in myasthenia gravis may reveal the presence of lymphoid cells in both.

As regards the response of the paretic ocular muscles in exophthalmic ophthalmoplegia to prostigmine, this study is not pertinent. In myasthenia gravis associated with paralysis of the extraocular muscles the injection of prostigmine rarely does more than improve or abolish the ptosis, and in exophthalmic ophthalmoplegia ptosis usually is not present.

Summary of Ocular Signs

This study has nothing to add to what has already been written regarding the ocular signs of myasthenia gravis.

However, the following observations were made: (1) Ocular symptoms and/or signs were present in all cases. (2) Purely "ocular" myasthenia gravis was observed several times, but in such cases there is always the possibility of spread of the weaknesses. (3) The ocular symptoms

and signs usually appear early in the course of the disease, but occasionally they are a late development. (4) Ptosis is the most constant ocular sign. (5) Edema of the lids is a rare prodromal sign. (6) Retraction of the lids is a rare ocular sign which was observed in one case after a chronic ptosis. (7) The similarity of abnormal associated movements of the lids in myasthenia gravis, and as a result of misdirection of regenerated fibers in the third nerve, was noted. An explanation for these lid phenomena in myasthenia gravis was not attempted. (8) Weakness of the orbicularis oculi may occur in the absence of ptosis or with it. Probably weakness in closure of the lids is overlooked more often than any other common ocular sign. (9) Limitation of ocular movements occurs unilaterally or bilaterally and in almost all combinations. (10) When pupillary abnormalities are present, it is doubtful if the case is one of myasthenia gravis. (11) Changes in accommodation were observed in only one case. (12) The visual fields and visual acuity are not altered. (13) The similarity of the ocular signs seen in myasthenia gravis and in thyroid states is noteworthy.*

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References

Abraham, S. V. Arch. of Ophth., 1932, v. 7, pp. 700-719.

Adams, M., and Power, M. H. Proc. Staff Meet., Mayo Clin., 1934, v. 9, pp. 598-599.

Adams, M., Power, M. H., and Boothby, W. M. Ann. Int. Med., 1936, v. 9, pp. 823-833; Jan. Correction, Ibid., v. 9, p. 1170.

Bell, E. T. Jour. Nerv. and Ment. Dis., 1917, v. 45, pp. 130-143.

Bender, M. B. Arch. of Ophth., 1936, v. 15, pp. 21-30.

Bernard, Claude. Substances toxiques. Paris, 1857, p. 344.

Blackman, S. S., Jr. Personal communication.

Booth, J. A. Jour. Nerv. and Ment. Dis., 1908, v. 35, pp. 690-694.

Brain, W. R. Diseases of the nervous system. London, Oxford University Press, 1933, pp. 686-691.

Buzzard, T. Brit. Med. Jour., 1900, v. 1, pp. 495-496.

Cannon, W. B. Amer. Jour. Med. Sci., 1939, v. 198, pp. 737-750.

Cannon, W. B., and Rosenblueth, A. Autonomic neuro-effector systems. New York, The Macmillan Company, 1937; Amer. Jour. Physiol., 1940, v. 130, pp. 219-229.

Cobb, S., and Forbes, A. Amer. Jour. Physiol., 1923, v. 65, pp. 234-251.

Collier, J. S. Brain, 1927, v. 50, pp. 488-498.

Courtis, B., and Sitler, R. Arch. bras. de Oft., 1942, v. 5, pp. 163-179.

Curschmann, H. Ergeb. d. inn. Med. u. Kinderh., 1922, v. 21, pp. 467-497.

Dale, H. H. The Harvey lectures, 1937, v. 32, pp. 229-245; also Bull. New York Acad. Med., 1937, v. 13, pp. 379-396.

Dale, H. H., and Feldberg, W. Jour. Physiol., 1934, v. 81, pp. 39-40.

Dale, H. H., Feldberg, W., and Vogt, M. Jour. Physiol., 1936, v. 86, pp. 353-380.

Duke-Elder, W. S., and Duke-Elder, P. M. Proc. Roy. Soc. London, 1930-31, v. 107, pp. 332-343.

Ford, F. R. Diseases of the nervous system in infancy, childhood, and adolescence. Springfield, Ill., Charles C Thomas, 1937, pp. 889-893.

———. Bull. Johns Hopkins Hosp., 1941, v. 68, pp. 309-318.

Gavey, C. J. Proc. Roy. Soc. Med., 1941, v. 35, pp. 14-15.

Grinker, R. R. Neurology. Springfield, Ill., Charles C Thomas, 1934, pp. 821-824.

Guthrie, L. G. Lancet, 1903, v. 1, p. 330.

Hart, H. H. Arch. Neurol. and Psychiat., 1927, v. 18, pp. 439-442.

Harvey, A. M., and Masland, R. L. Bull. Johns Hopkins Hosp., 1941, v. 69, pp. 1-13.

———. Jour. Pharmacol. and Exp. Ther., 1941, v. 73, pp. 304-311.

Harvey, A. M., and Whitehill, M. R. Jour. Amer. Med. Assoc., 1937, v. 108, pp. 1329-1333.

———. Bull. Johns Hopkins Hosp., 1937, v. 61, pp. 216-217.

Harvey, A. M., Lilienthal, J. L., Jr., and Talbot, S. A. Bull. Johns Hopkins Hosp., 1941, v. 69, pp. 529-546.

———. Bull. Johns Hopkins Hosp., 1941, v. 69, pp. 547-565; Ibid., pp. 566-577.

Jones, M. S., and Stadie, W. C. Quart. Jour. Exp. Physiol., 1939, v. 29, pp. 63-67.
Kawaichi, G. K., and Ito, P. K. Amer. Jour. Dis. Child., 1942, v. 63, pp. 354-356.
Klar, J. Klin. M. f. Augenh., 1930, v. 85, pp. 224-228.
Laurent, L. P. E. Lancet, 1931, v. 1, pp. 753-754.
Lindsley, D. B. Brain, 1935, v. 58, pp. 470-482.
McAlpine, D. Brain, 1929, v. 52, pp. 6-22.
Marinesco, G. Semaine méd., Paris, 1908, v. 28, pp. 421-429.
Moehlig, R. C. Jour. Amer. Med. Assoc., 1940, v. 115, pp. 123-125.
Moore, M. T. Arch. of Ophth., 1941, v. 26, pp. 619-625.
Nevin, S. Brain, 1934, v. 57, pp. 239-254.
Noyes, A. P. Rhode Island Med. Jour., 1930, v. 13, pp. 52-59.
Palmer, A. S. M. Guy's Hosp. Rep., London, 1908, v. 62, pp. 55-133.
Posey, W. C., and Spiller, W. G. The eye and nervous system. Philadelphia, J. B. Lippincott Co., 1906, pp. 457-462.
Rabinovitch, V., and Vengrjenovsky, G. Arch. d'Opht., 1935, v. 52, pp. 23-31.
Rea, R. L. Neuro-ophthalmology. St. Louis, C. V. Mosby Co., 1941, pp. 345-347.
Rothbart, H. B. Jour. Amer. Med. Assoc., 1937, v. 108, pp. 715-717.
Rottino, A., Poppiti, R., and Rao, J. Arch. Path., 1942, v. 34, pp. 557-561.
Sloan, H. E., Jr. Surgery, 1943, v. 13, pp. 154-174.
Strümpell, A. Deutsche Zeit. f. Nervenh., 1896, v. 8, pp. 16-40.
Taylor, J. Proc. Roy. Soc. Med., 1912-13, v. 6, p. 69 (Neurological Section).
Tilney, F. Neurographs, 1907-1915, v. 1, pp. 20-46.
Viets, H. R. Arch. Neurol. and Psychiat., 1942, v. 47, pp. 859-862.
Viets, H. R., Schwab, R. S., and Brazier, M. A. B. Jour. Amer. Med. Assoc., 1942, v. 119, pp. 236-242.
Walker, M. B. Lancet, 1934, v. 1, pp. 1200-1201; Proc. Roy. Soc. Med., 1935, v. 28, pp. 759-761.
Walsh, F. B., and King, A. B. Arch. of Ophth., 1942, v. 27, pp. 1-33.
Weigert, C. Neurol. Centralbl., 1901, v. 20, pp. 597-601.
Wilbrand, H., and Saenger, A. Neurologie des Auges, 1900, v. 1, pp. 219-235.
Williams, B. W., and Dyke, S. C. Quart. Jour. Med., 1921-22, v. 15, pp. 269-2781.
Wilson, S. A. K. Neurology. Baltimore, William Wood and Co., 1940, v. 2, pp. 1595-1607.
Woollard, H. H. Jour. Anat., 1931, v. 65, pp. 215-223.

THE STANDARDIZATION OF SO-CALLED SCHIÖTZ TONOMETERS*

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The word "so-called" has been added to the title to express the well-known fact that many of the Schiötz tonometers in use in the United States do not meet the physical specifications set up for such tonometers by Schiötz himself, not to mention the more rigid specifications set up by more recent workers in this field. Differences between the standard tonometer which Schiötz used in his calibration work and the tonometers used in the practice of ophthalmology may be the result of inaccurate, careless construction as well as of wear and tear. While a certain amount of the latter was unavoidable (because of the nature of the metals used), differences in construction could have been eliminated if all manufacturers had been induced to turn out only accurate replicas of the original instrument. No official action of that sort was taken, and the manufacture of Schiötz tonometers was taken up by a number of small firms and independent instrument makers who copied an original Schiötz instrument to the best of their ability and understanding. The situation was made worse by the fact that in some respects instruments manufactured and certified under the supervision of Schiötz and his technical assistant A. Tandberg did not comply with their own specifications. Among the 27 original Schiötz tonometers which I have examined and tested there has not been a single one whose plunger assembly (that is plunger plus lowest weight plus hammer and pointer) exerted the specified weight of 5.5 grams. In the majority of these tonometers the plunger assembly weighed between 6 and 6.2 grams; that is, about 11 percent more than specified. Posner and Schoenberg[1] have obtained similar findings. The resulting error amounts to about 3 mm. of intraocular pressure within the range of 20 to 30 mm.

The inaccuracy of the German reproductions of the Schiötz tonometer and its effect upon practical tonometry became very apparent after World War I. The need was felt of methods to determine (1) how much a given instrument deviated in its physical properties from those of a Norwegian standard instrument and (2) what the effect of such deviations was upon the tonometric reading with a representative group of human eyes. To subject a given tonometer to such methods means standardization. Personally I feel that standardization should, if possible, include measures to correct deviations found under (1), so that on a representative group of eyes, the particular instrument will give readings closely approximating those of a standard tonometer. It should be remembered that standardization and calibration are two different things. The latter term implies the conversion of tonometric readings into units of intraocular pressure, whereas the former comprises measures that will assure a uniformity of the tonometric reading with different tonometers.

During the last 20 years the problem of standardization has received a great deal of attention. Much talent, ingenuity, and plain "elbow grease" have been applied to it. The net result is that there still is no simple, generally accepted meth-

* From the Illinois Eye and Ear Infirmary, The University of Illinois. Read before the Chicago Ophthalmological Society on March 20, 1944.

od of standardization (Sachs and MacCracken[2]). In principle two methods are in use:

1. The physical properties of the tonometer in question are measured with suitable gauges, calipers, and scales and compared with those of a standard tonometer.

2. The performance of the tonometer in question is compared with that of a standard instrument on the eye or eyes of animals, or on a cornealike membrane which is part of an "artificial eye."

It might be well to review briefly the principles of tonometry with an instrument of the Schiötz type. During the application of the instrument two independent weights rest upon the eye. There is the foot plate plus cylinder, frame, and graduated arc which weigh roughly 11 grams and rest upon a fairly large portion of the cornea. The curvature of the footplate is very much less than that of the cornea. The natural effect of the application of the foot-plate assembly is an "applanation" of an area of the cornea the size of which depends upon the intraocular pressure. The lower the intraocular pressure the greater is the flattened-out area of cornea. The change in shape and curvature of the cornea brought about by the foot-plate assembly is called the *deformation* or *distortion.* The second weight is incorporated in the plunger assembly, that is the plunger plus weights, hammer, and pointer. This is the weight that should be 5.5, 7.5 or 10 grams, respectively. To this weight pointer and hammer contribute an amount of about 2.2 grams, varying slightly with the position of the pointer. The plunger assembly indents the central portion of the cornea. This change in shape and cornea is called the *indentation.* It is the depth of that indentation beyond the level of the deformation which the tonometer measures and records 20 times magnified as the so-called *tonometric* reading or *swing.* In the light of this analysis the essential physical properties of the tonometer would be: (1) size and curvature of the foot plate, since they determine the shape of the deformation; (2) the weight of the foot plate assembly, since it determines the size of the deformed flattened bulbus area; (3) diameter and curvature of the end of the plunger, since they determine the shape of the indentation; (4) the weight of the plunger assembly, since it determines the depth of the indentation; (5) the lever ratio and general construction of the magnifying and recording device.

Now let us turn to the ocular factors which determine the tonometric reading. Obviously, the main factor opposing indentation and deformation is the intraocular pressure. The experimental work of Schiötz and Priestley Smith revealed considerable and consistent variations of the tonometric reading on eyes whose intraocular pressure had been brought to exactly the same level. Logically, Schiötz thought that differences in ocular size and in thickness and elasticity of the eyeball wall account for these variations. Friedenwald's brilliant mathematical analysis of tonometry[3] has taught us to distinguish clearly between two factors that determine the impressibility of the eye, which is what the tonometer measures. With an ingenious method based upon two successive tonometries with widely divergent weights Friedenwald showed that the tonometric reading could be broken down into its two components, the intraocular pressure and the ocular rigidity. Unfortunately, the tonometers that have been available during the last 10 years are not accurate enough to permit reproducible rigidity determinations except under very favorable conditions. In my own hands, Friedenwald's method has convinced me of the existence of consistent differences

in ocular rigidity in different eyes. I do not believe that I know the limits of physiologic variations of ocular rigidity, although they must be about as great as those suggested by Schiötz's findings in his calibration work. It is to be hoped that postwar refinements of the Schiötz tonometer will permit accurate rigidity determinations on a large scale, which, I am confident, will confirm the soundness of Friedenwald's concept. Until then I believe we shall have to assume, in the practice of ophthalmology, that the eyes whose intraocular pressure we wish to determine by tonometry possess *average* ocular rigidity, and convert tonometric readings into millimeters of intraocular pressure by using Schiötz's nomogram of 1924[4] with the minor corrections suggested by Friedenwald in 1937.

The concept of ocular rigidity has a very definite bearing upon the standardization of tonometers if the latter is done on single artificial, animal, or human eyes. If this eye possesses average ocular rigidity, it is probable that two tonometers which check well on this eye (or device) will also check well under ordinary clinical conditions. If the eye or device used for standardization does not possess average rigidity it is not certain at all that a match between two tonometers under laboratory conditions will remain a match in clinical practice. Eyes with average rigidity usually give identical or parallel calibration curves. Eyes with low or high rigidity often give calibration curves that are not parallel to those of eyes with average rigidity. For that reason I believe it is necessary that standardizations done on animal or human eyes are made either on eyes proved to possess average rigidity or on large enough groups of eyes to make it probable that all variations of ocular rigidity are duly represented.

Standardization of tonometers by comparing the performance of unknown with that of a standard instrument on a representative specimen or group of animal or human eyes is cumbersome and difficult. It would be very time-consuming to carry out a large number of such standardizations.

The Committee on Standardization of Tonometers of the American Academy of Ophthalmology and Otolaryngology has adopted the other method of standardization; that is, the measurement of all important physical properties of the instrument. The details of the method have been worked out by Posner.[5] The main steps of the procedure concern: (1) size and curvature of the foot plate; (2) diameter and curvature of the end of the plunger.

If these measurements prove to be within the limits of tolerance approved by the Committee, the examiner proceeds to weigh: (3) the foot plate assembly and (4) the plunger assembly.

In these measurements determinations of the friction between cylinder and handle and the friction affecting upward movement of the plunger are included. The latter consists of the friction between plunger and cylinder, between plunger tip and the undersurface of the hammer, and at the fulcrum.

Finally, the magnifying and recording device is checked; a micrometer gauge providing indentations of varying depth is used for this purpose.

The deviations from the standard encountered most commonly are faulty weights of either the foot plate or the plunger assembly or inaccuracies of the magnifying and recording device, the lever ratio being greater or smaller than 1:20 or being discontinuous.[1] The effect of all these deviations upon the tonometric reading can be figured out mathematically following principally Friedenwald's theory of tonometry, and the respective correction factors can be determined.

Thus it is possible, if the curvature and size of the foot plate and plunger end are within tolerable limits, to correct the existing deviations by providing a new calibration curve for the particular instrument. Such calibration curves have, in some instances, been very irregular and discontinuous. The computation of these curves has occasionally been so complicated that I have had doubts as to the reliability of the final result.

For that reason I started about 18 months ago to subject nine of these "corrected" tonometers to a rigid checking on a representative group of human eyes. Patients from my private practice as well as from the Illinois Eye and Ear Infirmary volunteered for this purpose after they were told that I would like to check their intraocular pressure with two different instruments. Patients with known or rather consistent ocular rigidity were selected for this purpose. The range of intraocular pressures covered was from 15 to 45 mm. of mercury. Each tonometer was compared with a standard on at least 20 different human eyes. While this again was a time-consuming process it was very gratifying to see that tonometers corrected by the foregoing method showed no significant differences in the tonometric measurements in more than 1 out of 10 checks of human eyes. Thus I proved at least to my own satisfaction that our method of correcting tonometers made them perform in close agreement with the standard. The method of standardizing tonometers by measuring the physical properties is therefore practically sound.

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References

[1] Posner, A., and Schoenberg, M. J. Amer. Jour. Ophth., 1944, v. 27, April, p. 368.
[2] Sachs, E., and MacCracken, F. L. Arch. of Ophth., 1943, v. 29, May, p. 782.
[3] Friedenwald, J. S. Amer. Jour. Ophth., 1937, v. 20, Oct., p. 985.
[4] Schiötz, H. Acta Ophth., 1924, v. 2, p. 1.
[5] Posner, A. Arch. of Ophth., 1943, v. 30, July, p. 1.

THE LENS IN ACCOMMODATION*

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The mechanism of accommodation has intrigued students of the eye, and a number of theories of its action have been proposed. Acceptable theories have in common the requirement of an elastic lens and an equatorial ligament pulling almost radially with sufficient force to change the form of the lens and give the eye a change of refracting power from 70.6 to 56.6 diopters. Fincham's observations placed the compressive force in the capsule and noted that the lens substance seemed to bulge through an opening as though it were pressing outward on the capsule at all points.

One difficulty with the theory of accommodation by relaxation has been the force required to change the lens form by elastic compression. Adler points out that the theoretical tension on the choroid at rest would destroy it. The ciliary muscle is small, particularly the long fibers which tense the choroid in relaxing the lens ligament. The lens is made of a very firm center whose rods are axially directed and not easily deformed even by finger pressure. And yet it is obvious to the touch that the axial diameter as a whole can be easily reduced. The interior of the lens, therefore, was investigated to find any feature that would permit a small force to accomplish large changes in form.

The lens develops from an ectodermal vesicle whose medial wall grows into long parallel lens rods, whereas the lateral wall remains a cellular lens membrane. Additions of cells to the nucleus at its margins are made from this membrane, so that from the beginning the lens form grows flatter and its focal length increases. Long before birth the lenticular portion of the central retinal artery is obliterated, and the rods at or near the axis receive less nutriment and oxygen. As they fail to elongate, peripheral rods curve over them both medially and laterally from the equator toward the axis. Up to the time of birth this spheroidal lens is a continuum from the protoplasmic outer rods, with a refractive index of 1.33 to the nonliving dense protein mass of the center, where, in the adult, rod structure is not easily demonstrated. The refractive index of this center rises to 1.46. After birth, as the lens grows and at the same time functions increasingly in accommodation, stresses are set up tangential to the surface, and the rods become aligned in sheets. Between the sheets is albuminous liquid. One stress zone in particular contains more liquid than the rest and separates the nucleus from the surrounding cortex. The cortical lamination is equivalent to the menisci pictured by Cowan with diagrammatic simplicity.

The mature crystalline lens in tension and in relaxation is pictured in figure 1. It is seen that tension at the equator, besides slightly stretching the lens, moves liquid along the stress zone to the equator whereas in relaxation liquid moves back to the axis on both sides of the nucleus. The nucleus is held in position by strands that cross the liquid-filled zone, but the whole nucleus is moved forward. The force in this axial expansion is furnished partly through cortical elasticity and partly through hydrostatic pressure probably based on a small differential in osmotic pressure of lenticular fluid over surrounding fluids. The hydrostatic component operates uniformly in all directions, but its effectivneess on any wall varies directly with the radius of curvature of that wall

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and the thickness of the wall. The curved prismatic cortical lens rods in turgor tend to become straight and in doing so supply the necessary elastic component. These forces, taken together with the fact that the central or pupillary zone of the cortex is thin, permit the change in radius of curvature characteristic of accommodation in this region. This change does not extend to the whole lateral lens face.

The lenticular structure here pictured is found in the human eye after birth. In old age the liquid space is reduced or obliterated and the whole lens becomes, like the nucleus, an unyielding and highly refractive mass. Beef eyes are generally from young animals. The lens is double the diameter of the human lens, and the structure of the liquid stress zone is easily demonstrated.

The theory of lens elasticity presented here does not call for modification of accepted theories of accommodation but it does make more plausible the effectiveness of the force of tension in the lens ligament.

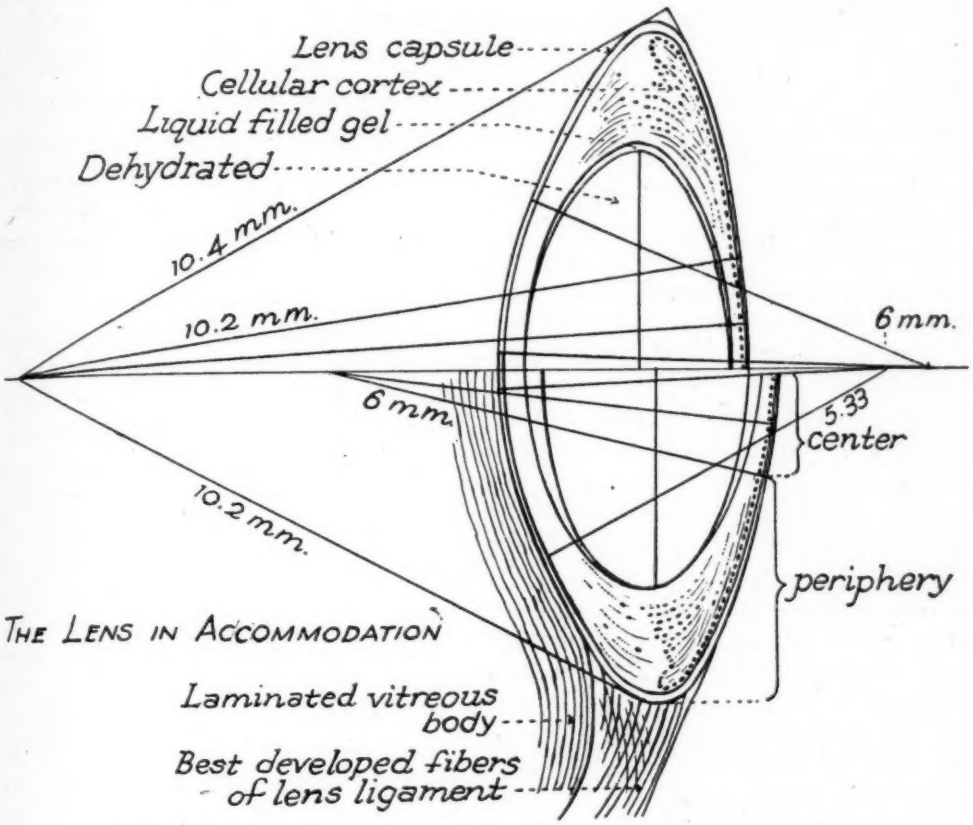

Fig. 1 (Sinclair). The mature crystalline lens in tension and in relaxation.

REFERENCES

Adler, F. H. Clinical physiology of the eye. Macmillan, 1933.
Cowan, A. Refraction of the eye. Lea and Febiger, 1938, p. 125.
Fincham, E. F. Changes in the form of the crystalline lens in accommodation. Amer. Jour. Phys. Optics, 1926, v. 7, pp. 469-521.

EXTRACTION OF SENILE CATARACT*

A STATISTICAL COMPARISON OF VARIOUS TECHNIQUES AND THE IMPORTANCE OF PREOPERATIVE SURVEY

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When the Wilmer Institute was opened, in 1925, the technique used for the extraction of senile cataract was a combined extracapsular extraction without conjunctival flap or sutures. This original technique has been modified gradually but radically during the past 19 years by the following successive changes: the use of a conjunctival or "pocket" flap closed with sutures; intracapsular extraction by the tumbling method with forceps; the use of one or two corneoscleral sutures; and, finally, the preservation of a round pupil. The material for this study consists of all the operations for uncomplicated senile cataract either by the resident house staff or the full-time staff of the Institute between 1925 and October, 1943, a total of 2,086 extractions. It is the object of this paper (1) to compare the results obtained by the different methods used during this period, and (2) to determine the factors which obviate complications and produce the best end results. In later papers, various details and corollaries uncovered in this survey will be discussed. In this study, no factor will be considered to have any statistical significance unless the probability of error is less than 1 in 20.

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RESULTS OF VARIOUS TECHNIQUES

When the gradually shifting technique is viewed in retrospect, five distinct methods of extraction become apparent; namely, (A) capsulotomy followed by extracapsular extraction, with a full iridectomy, and without the use of conjunctival flap or sutures; (B) combined extracapsular extraction using a conjunctival flap closed with sutures; (C) combined intracapsular extraction with conjunctival sutures; (D) combined intracapsular extraction with one or two McLean-type silk corneoscleral sutures; and (E) round-pupil intracapsular extractions, usually with two corneoscleral sutures and one peripheral iridotomy. These five groups are of unselected cases, but do not include 436 operations with other combinations of technique; for example, keratome incision followed by capsulotomy and lavage, extracapsular extraction with corneoscleral suture or round pupil, or unsuccessful intracapsular attempts with rupture of the capsule.

The incidence of complications which followed each of the five techniques is given in table 1a. Loss of vitreous occurred most frequently in combined intracapsular extractions, and least often in round-pupil intracapsular extractions. Incomplete closure of the corneal wound at the end of the seventh postoperative day and prolapse of the iris were greatly reduced by the use of one and especially of two corneoscleral sutures. Anterior-chamber hemorrhages occurred most frequently after combined intracapsular

extractions with conjunctival sutures and least frequently after round-pupil intracapsular extractions with two corneoscleral sutures. The incidence of postoperative iridocyclitis decreased markedly with total extraction of the lens. Secondary glaucoma became less frequent following intracapsular extractions with corneoscleral sutures. Detachment of the retina was somewhat higher in the early intracapsular extractions with conjunctival sutures.

Table 1b. Over one third of the extracapsular extractions later had to be followed by at least one discission to obtain satisfactory vision. In some cases, it was also necessary to reopen the eye with a keratome to perform a capsulectomy or lavage of cortical remains. In spite of these measures to clear the pupillary space, 16 percent of those having had extracapsular extractions obtained a final vision of less than 20/30 solely because of residual capsular remains or the de-

TABLE 1a

COMPLICATIONS FOLLOWING VARIOUS TECHNIQUES OF CATARACT EXTRACTION

Technique	No. of Cases	Loss of Vitreous percent	Incomplete Closure of Wound percent	Prolapse of Iris percent	Anterior-Chamber Hemorrhage percent	Iridocyclitis percent	Secondary Glaucoma percent	Detachment of Retina percent
A. Extracapsular Full iridectomy Without sutures	373	6.7	5.1	4.3	8.0	15.5	5.3	1.3
B. Extracapsular Full iridectomy Conjunctival sutures	266	5.6	4.1	4.1	9.8	9.4	7.5	1.9
C. Combined intracapsular Conjunctival sutures	207	14.5	4.3	6.8	15.0	5.8	5.8	3.4
D. Combined intracapsular Corneoscleral sutures	424	12.7	1.9	1.7	10.8	2.8	2.4	1.3
E. Round pupil Intracapsular Corneoscleral sutures	380	2.7	0.3	1.3	4.5	1.4	1.6	0.5

TABLE 1b

RESULTS OF VARIOUS TECHNIQUES OF CATARACT EXTRACTION

Technique	No. of Cases	Discission percent	Capsulectomy or Lavage percent	Residual Capsular Remains percent	Astigmatism 5D. and Over percent	Visual Results percent				
						No. of Cases **	20/15 to 20/30	20/40 to 20/70	20/100 to 20/200	Less than 20/200
A. Extracapsular Full iridectomy Without sutures	373	38.1	7.0	18.2	16.2	257	65.4	15.6	4.3	14.9
B. Extracapsular Full iridectomy Conjunctival sutures	266	34.2	4.2	13.9	15.9	193	76.2	12.4	4.2	7.4
C. Combined intracapsular Conjunctival sutures	207	3.4	1.0	1.0*	8.1	142	79.0	6.3	4.2	10.5
D. Combined intracapsular Corneoscleral sutures	424	0.5	0.7	0.2*	1.2	301	85.7	8.6	2.0	3.3
E. Round pupil Intracapsular Corneoscleral sutures	380	0.8	0	0.5*	0.6	268	91.7	4.5	1.2	1.9

* Pupillary space occluded by organized material or iris drawn up by anterior synechiae.
** Excluding those without adequate refraction or with extraneous causes of poor vision; for example, senile macular degeneration.

velopment of Elschnig bodies. Many of these patients refused to have secondary operations performed. In a few instances after intracapsular extractions, it was necessary to perform a secondary operation to open a pupil occluded by organized exudate or drawn up by anterior synechiae. The percentage of eyes having a final astigmatism of 5 diopters or more became progressively less with the use of sutures to close the corneal wound more securely.

Tabulation of the final visual results includes only those patients who had an adequate refraction and had no causes of poor vision independent of the cataract extraction; for example, senile macular degeneration or other pathologic condition. In addition, those patients with a final vision of less than 20/30 because of residual capsular remains were excluded unless an attempt had been made to open the pupillary space by a discission or capsulotomy. The average postoperative follow-up of groups A to E varied, respectively, from 23 months to 6 months, the average for all groups being 14 months. Table 1b shows that the percentage of patients who obtained good vision progressively rose with each change in technique, and, with the exception of group C, the incidence of poor visual results diminished. The gradual improvement in final visual results of each successive method was also manifest in the tabulation of all cases, including those cases excluded from table 1b ("Visual results").

In summary, with each change in technique during the past 19 years, the incidence of postoperative complications has become lower and the final visual results have become better except for the early technique of combined intracapsular extraction with conjunctival sutures used between 1930 and 1937, which was associated with a higher incidence of certain complications such as loss of vitreous, prolapse of iris, anterior-chamber hemorrhage, and detachment of the retina. The question therefore arises; what are the individual factors in operative technique that have a significant influence on postoperative complications and the final result?

Factors in operative technique influencing postoperative course

1. Residual lens cortex and capsule after nontotal or extracapsular extraction. In this study, a patient was considered to have postoperative iridocyclitis if the eye remained congested externally and the aqueous ray persisted for over three weeks after operation, if nonspecific protein-fever therapy was instituted, or if signs of iridocyclitis developed later (for example, inflammatory changes in the iris, positive aqueous ray, and K.P. deposits on the posterior surface of the cornea). Iridocyclitis was found to be more common after extracapsular than after intracapsular extractions (table 2). Almost one third of the patients with retained lens cortex developed postoperative iridocyclitis. In respect to this complication: Is an unsuccessful attempt at intracapsular extraction (that is, an unintentional rupture of the capsule during delivery) less desirable than an intentional extracapsular extraction with capsulotomy? Analysis of

TABLE 2

Influence of residual capsule and cortex on the development of postoperative iridocyclitis

Technique	No. of Cases	Iridocyclitis percent
Extracapsular with cortical remains	169	31.4
Extracapsular without cortical remains	854	8.4
Intracapsular	1046	2.8

the figures shows that the incidence of retained cortex and postoperative iridocyclitis was essentially the same in both groups (table 3). Also, accidental rupture of the capsule was not accompanied by any increase in the frequency of vitreous loss compared to successful intracapsular extractions.

Attempted intracapsular extractions have been considered unsuccessful if the capsule ruptured either in the eye or when emerging through the wound. Prior to 1939, 37 percent of capsules were ruptured during delivery. Between 1939 and 1943, 19 percent of capsules were ruptured. The tumbling method with the Kalt forceps was used in the early years and later the Arruga or Castroviejo forceps was substituted. Occasionally the Barraquer suction cup was used for hypermature lenses. The incidence of broken capsules was highest for mature and

TABLE 3

COMPARISON OF UNSUCCESSFUL INTRACAPSULAR (BROKEN CAPSULE) VS. INTENTIONAL EXTRACAPSULAR EXTRACTIONS

Technique	No. of Cases	Cortical Remains percent	Iridocyclitis percent
Unsuccessful attempt at intracapsular (broken capsule)	338	16.3	10.9
Intentional extracapsular (with capsulotomy)	668	16.6	13.0

hypermature lenses, and in patients under 50 or over 80 years of age. Assistant residents were as successful in extracting the lenses in capsule as were operators of more experience. The junior men, however, operated chiefly on eyes in selected cases.

2. Loss of vitreous. Loss of vitreous has been classified into three groups: "presentation" of vitreous refers to a re-formed anterior chamber following extraction of the lens without external loss of vitreous; moderate loss refers to a visible loss of formed or semiformed vitreous; and severe loss indicates the loss of a large amount of formed vitreous usually with softening of the globe. Loss of vitreous predisposed to the development of persistent vitreous opacities and simple detachment of the retina (table 4). In addition, loss of vitreous increased the frequency of iridocyclitis after intracapsular extractions, in which group of cases the factors of capsular or cortical remains were excluded (table 4a). The persistent vitreous opacities subsequent to vitreous loss were found to originate from iridocyclitis and vitreous hemorrhage. Over one half of the round-pupil extractions complicated by presentation or loss of vitreous resulted in irregularity of the pupil, often with anterior peripheral synechiae. Uncomplicated round-pupil extractions showed some irregularity of the pupil in 10 percent of the cases.

TABLE 4

RELATION OF VITREOUS LOSS TO THE DEVELOPMENT OF POSTOPERATIVE COMPLICATIONS (ALL CASES)

Loss of Vitreous	No. of Cases	Persistent Vitreous Opacities percent	Retinal Detachment percent
None	1720	6.6	0.9
Presentation	154	16.2	1.3
Moderate	141	19.6	5.7
Severe	46	37.2	10.9

TABLE 4a

RELATION OF VITREOUS LOSS TO POSTOPERATIVE COMPLICATIONS (INTRACAPSULAR ONLY)

Loss of Vitreous	No. of Cases	Postoperative Iridocyclitis percent
None	861	1.2
Presentation	79	12.7
Moderate or severe loss	96	8.3

Relative importance of capsular or cortical remains and vitreous loss with re-

TABLE 5

RELATIVE IMPORTANCE OF CAPSULAR OR CORTICAL REMAINS AND VITREOUS LOSS ON FINAL VISUAL RESULT

Technique		No. of Cases*	Vision (percent)		
			20/15–20/30	20/40–20/200	Less Than 20/200
No loss of vitreous	Intracapsular	608	91.0	6.2	2.8
	Extracapsular	519	81.0	12.6	6.4
	Cortical remains	94	54.2	22.4	23.4
Presentation of vitreous	Intracapsular	59	76.3	15.2	8.5
	Extracapsular	41	65.8	26.9	7.3
	Cortical remains	11	72.7	18.2	9.1
Moderate loss of vitreous	Intracapsular	48	68.8	18.7	12.5
	Extracapsular	32	62.5	18.8	18.7
	Cortical remains	11	27.2	45.6	27.2
Severe loss of vitreous	Intracapsular	17	53.0	29.4	17.6
	Extracapsular	10	30.0	50.0	20.0
	Cortical remains	8	25.0	12.5	62.5

* Excluding those without adequate postoperative refraction or with extraneous causes of poor vision; for example, senile macular degeneration.

spect to the final visual result. The previous figures have shown the undesirable effects of either retained lens material or vitreous loss. If the capsule ruptures inadvertently during an attempted intracapsular extraction, the objectionable effects of residual capsule or cortex must be balanced against the danger of vitreous loss should the attempt be made to remove the residual lens material (table 5). A comparison of the visual results shows that severe vitreous loss and cortical remains are equally deleterious. However, while simple presentation of the vitreous is slightly more detrimental than leaving capsular remains, it is not nearly so serious as leaving lens cortex in the eye. From this, it would appear justifiable to attempt the removal of lens cortex in all cases even at the possible expense of vitreous loss. On the other hand, the removal of purely capsular material is advisable only if such an attempt is not accompanied by undue hazard of breaking the hyaloid membrane.

3. Sutures. Analysis of the data on the basis of sutures alone confirms the previous impression that tight closure of the corneal wound decreases gaping of the wound, prolapse of the iris, and final astigmatism (table 6). In extractions complicated by loss of vitreous, corneo-

TABLE 6

INFLUENCE OF SUTURES ON POSTOPERATIVE COMPLICATIONS

Sutures	No. of Cases	Anterior-Chamber Hemorrhage percent	Incomplete Closure of Corneal Wound percent	Prolapse of Iris percent	Average Astigmatism diopters
None	390	7.7	4.9	4.1	2.7
Conjunctival	629	12.2	4.1	4.9	2.5
Corneoscleral (one)	482	13.3	1.2	2.7	1.7
Corneoscleral (two)	558	4.7	1.4	1.6	1.4

TABLE 6a

EFFECT OF CORNEO-SCLERAL SUTURES ON REDUCING SOME COMPLICATIONS OF VITREOUS LOSS

Loss of vitreous	Corneoscleral Sutures	No. of Cases	Incomplete Closure of Wound (7 days) percent	No. of Cases	Astigmatism 5D or More percent
None	None	838	2.3	559	9.8
	Present	861	0.9	602	1.0
Presentation or loss	None	170	14.7	102	27.0
	Present	169	3.5	106	1.9

scleral sutures even more significantly reduced the likelihood of incomplete closure of the corneal wound and a high degree of astigmatism (table 6a). The use of two corneoscleral sutures (table 6) has reduced the incidence of anterior-chamber hemorrhages. The relatively low incidence of anterior-chamber hemorrhages in those cases in which no sutures were used might be accounted for by the shallow corneal sections in vogue at that time.

The use of sutures has been associated with an increase of purulent endophthalmitis, but, as Guyton and Woods have indicated,[2] this complication can be eliminated by the use of prophylactic sulfadiazine systemically for the first few days after operation (table 6b). The local use of chemotherapeutic agents is not so efficacious. When 5-percent sulfathiazole ointment was used locally in the eye immediately after the operation and usually at each dressing thereafter, two patients of 116 so treated developed purulent ophthalmitis, although stitch abscesses were not encountered . Additional measures that have effectively prevented this complication include an iodine-alcohol clean-up of the skin instead of merthiolate, metaphen, or zephiran, and careful draping in order to cover completely the nose, brow, and most of the skin.

Difficulty was encountered occasionally in the removal of corneoscleral sutures. The anterior chamber was lost either during the removal of sutures or more frequently was found collapsed the following day in 3.7 percent of 1,030 cases. Serious gaping of the wound rarely ensued, and the anterior chamber ordinarily re-formed within 48-hours. Small anterior-chamber hemorrhages occurred at the time of removal of sutures in 3.6 percent of the 1,030 cases. If the suture is deeply placed or if the patient is uncoöperative, removal of sutures can be postponed beyond the tenth postoperative day, and removal will be easier one or two weeks after discharge from the hospital.

TABLE 6b

RELATION OF SUTURES AND PROPHYLACTIC SULFADIAZINE TO POSTOPERATIVE PURULENT ENDOPHTHALMITIS

Sutures	No. of Cases	Purulent Endophthalmitis percent
None	389	0.5
Conjunctival	628	1.0
Corneoscleral No sulfadiazine	648	1.7
Corneoscleral Prophylactic Sulfadiazine	276	0

4. Iridectomy. In the entire series round-pupil extractions have been compli-

TABLE 7

RELATION OF TYPE OF IRIDECTOMY TO LOSS OF VITREOUS

Iridectomy	No. of Cases	Loss of Vitreous percent
Round pupil	444	2.7
Complete iridectomy	1635	10.6

cated by loss of vitreous less often than when extractions were preceded by a full iridectomy (table 7). It was not the usual procedure to perform an iridectomy following the loss of vitreous during a round-pupil extraction. However, when there was an accidental rupture of the capsule, a full iridectomy was often performed on the previously round pupil to facilitate the removal of capsular and cortical remains.

It has been suggested that the attempt to remove the cataractous lens through a round pupil increases the danger of rupture of the capsule. This is true in the extraction of hypermature lenses, especially when the pupils are rigid and dilate poorly with mydriatics. However, this factor was not important in the usual case of our series. The incidence of broken capsules became lower during the last five years when round-pupil intracapsular extractions were attempted in practically every case.

Postoperative anterior-chamber hemorrhages have only a suggestive relationship to the degree of iris trauma at operation.

5. Factors in the production of secondary glaucoma. The development of postoperative iridocyclitis, either from residual lens cortex or from loss of vitreous, predisposed to the development of secondary glaucoma (table 8). Other factors that have a suggestive but not statistically significant relation to secondary glaucoma in this series are: nonre-formation of the anterior chamber for at least seven days after operation, capsular and cortical remains without associated iridocyclitis, and presentation or loss of vitreous without iridocyclitis.

TABLE 8

POSSIBLE FACTORS IN THE PRODUCTION OF SECONDARY GLAUCOMA AFTER CATARACT EXTRACTION

Complication		No. of Cases	Secondary Glaucoma percent
Iridocyclitis	Present	144	19.4
	Absent	1919	3.1
Flat anterior chamber over seven days	Present	23	17.4
	Absent	2062	4.3
Capsular and cortical remains (without iridocyclitis)	Cortex	123	6.5
	Capsule	788	4.1
	None	1008	1.9
Presentation or loss vitreous (without iridocyclitis)	Loss	296	4.1
	None	1615	2.9

INFLUENCE OF GENERAL MEDICAL CONDITIONS ON POSTOPERATIVE COMPLICATIONS

1. Foci of infection. Many of the patients, particularly in the earlier days of the Wilmer Institute, underwent a thorough search for foci of systemic infection prior to operation for cataract. This included a general physical examination by the interne, routine consultation with the nose and throat department (usually including X-ray studies of the sinuses), dental consultation with X rays, consultations with the gynecologic or urologic departments if indicated, blood Wassermann test, urine examination, and often tuberculin-sensitivity tests and X ray of the chest. An analysis of the incidence of postoperative iridocyclitis in relation to preoperative foci of infection revealed a curious finding in the group of patients subjected to extracapsular extraction (table 9). In this group, the patients whose foci of infection (in teeth

or sinuses) were either untreated or inadequately treated showed essentially the same incidence of postoperative iridocyclitis as those with no demonstrable focus of infection. However, the patients whose foci of infection were adequately treated prior to the extracapsular extraction developed postoperative iridocyclitis much less frequently than either the untreated and inadequately treated group or the group with no demonstrable focus of infection. An explanation of this finding is not readily apparent and will be the subject of a future report.

2. Diabetes. Only those diabetics who had had diabetes for nine years or more, or required 30 units or more of insulin showed any increase in postoperative complications (table 10). These groups were more prone to develop severe anterior-chamber hemorrhages, defined in this study as either a single hemorrhage completely filling the anterior chamber or smaller recurrent hemorrhages. No significant correlation was obtained between the height of the pre- or postoperative blood sugar, insulin shock, or diabetic acidosis, and any postoperative complication.

3. Systemic hypertension. No relationship was obtained between the height of either systolic or diastolic blood pressure and any postoperative complication. Two out of the three patients who developed expulsive choroidal hemorrhages and normal blood pressure, but all were over 70 years of age.

4. Syphilis. In this study 105 patients had late and usually latent syphilis. They showed no tendency toward increased postoperative complications. No difference was found between treated and untreated syphilitics.

Discussion

Iridocyclitis. The relative importance of the etiologic factors in postoperative iridocyclitis is somewhat uncertain. A survey of the literature reveals that iridocyclitis follows extracapsular more frequently than it does intracapsular extractions,[3] and we have found that the presence of retained lens cortex widens this difference. The most credible reasons why lens capsule and cortex should predispose to the development of postoperative iridocyclitis are (1) that bacteria are introduced into the residual lens material at the time of operation and therein find a good culture medium for growth, (2) that the individual becomes sensitized to his own lens protein and may develop varying degrees of endophthalmitis phacoanaphylactica, and (3) that lens material has intrinsic toxicity.[4] In regard

TABLE 9

RELATION OF PREOPERATIVE SURVEY AND POSTOPERATIVE IRIDOCYCLITIS AFTER EXTRACAPSULAR EXTRACTIONS

Survey	No. of Cases	Iridocyclitis percent
No focus	372	14.5
Focus Inadequate treatment	126	16.7
Focus Adequate treatment	115	4.4

TABLE 10

RELATION OF SEVERITY OF DIABETES TO SEVERE POSTOPERATIVE ANTERIOR-CHAMBER HEMORRHAGE

Severity of Diabetes	No. of Cases	Severe Anterior-Chamber Hemorrhage percent
Duration less than 9 years	166	1.8
Duration 9 years or more	58	10.4
Insulin per day less than 30 units	169	1.8
Insulin per day 30 units or more	55	10.9
Duration 9 years or more and insulin per day 30 units or more	19	21.0

to the possible factor of infection, we found that the incidence of purulent endophthalmitis was no higher in extracapsular than in intracapsular extractions, and was lowest in eyes with retained cortex. If infection were usually present in the cortical remains of eyes with iridocyclitis, it would be surprising that purulent endophthalmitis did not develop more frequently. Also we did not find that the prophylactic use of sulfadiazine had a significant effect on the prevention of iridocyclitis, although it is likely that sulfadiazine does not penetrate well into lens cortex. Infection also appears unlikely in those cases which do not develop iridocyclitis until several weeks after the operation. Reports in the literature indicate that such cases of late iridocyclitis often show evidence of cutaneous sensitivity to lens protein, and frequently respond well to lens-protein desensitization. A few of the reported cases with evidence of lens sensitivity have come to enucleation, and have shown the histologic picture of endophthalmitis phaco-anaphylactica.[5] The question arises whether most of the cases with iridocyclitis following extracapsular extraction possess this hypersensitivity to lens protein. A compilation of the data from the literature[6] shows that the cutaneous test for lens protein becomes positive in the large majority of cases with postoperative iridocyclitis (table 11). It may be that low-grade infection or a toxin facilitates such a sensitization to lens protein, as Burky has shown experimentally with staphylococcus toxin in rabbits.[7] This may be the role of foci of infection in the sinuses[8] or teeth.

TABLE 11

INCIDENCE OF POSITIVE LENS PROTEIN INTRACUTANEOUS TESTS IN PATIENTS WITH POSTOPERATIVE IRIDOCYCLITIS[6]

Postoperative Iridocyclitis	Author	No. of Cases	No. of Positive Skin Tests
Present	Verhoeff and Lemoine, 1922	12	12
	Lemoine and Macdonald, 1924	9	9
	Gifford and Steinberg, 1925	14	6
	Goodman, 1932	42	38
	Hughes and Owens, 1944	25	12
	TOTAL	102	77 (75%)
Absent	Verhoeff and Lemoine, 1922	28	0
	Lemoine and Macdonald, 1924	150	6
	Gifford and Steinberg, 1925	72	5
	Goodman, 1932	658	80
	Hughes and Owens, 1944	21	8
	TOTAL	929	99 (11%)

SUMMARY AND CONCLUSIONS

The gradual but radical changes in the technique of extraction of uncomplicated senile cataract during the past 19 years at the Wilmer Institute have brought about a steady improvement in final results. Statistical analysis of 2,086 extractions has shown that: (1) the amount of lens capsule and cortex remaining after an extracapsular extraction is directly related to the development of postoperative iridocyclitis, which, in turn, is the main factor in the production of secondary glaucoma; (2) loss of vitreous predisposes to postoperative simple detachment of the retina, persistent vitreous

opacities, and iridocyclitis; (3) corneoscleral sutures reduce the incidence of incomplete closure of the wound, prolapse of iris, the amount of final astigmatism, and, with two sutures, anterior-chamber hemorrhages; (4) preservation of the round pupil reduces the likelihood of vitreous loss; (5) diabetes of long standing or requiring 30 units of insulin or more per day predisposes to the development of severe anterior-chamber hemorrhages, but there is no correlation between the height of the blood-sugar and postoperative complications; (6) syphilis, either treated or untreated, and systemic hypertension have no significant influence on the occurrence of postoperative complications.

References

[1] McLean, J. M. A new corneo-scleral suture. Arch. of Ophth., 1940, v. 23, p. 554.

[2] Guyton, J. S., and Woods, A. C. Oral use of prophylactic sulfadiazine for cataract extractions. Amer. Jour. Ophth., 1943, v. 26, p. 1278.

[3] Elschnig, A. Die intrakapsuläre Starextraktion. Berlin, Julius Springer, 1932. Quoted by Nugent., O. B. Complications in cataract extraction. Amer. Jour. Ophth., 1934, v. 17, p. 135.

Saint-Martin, R. de. L'extraction capsulo-lenticulaire de la cataracte. Paris, Masson et Cie (Société Française d'Ophtalmologie publications), 1935.

Klein, M. Operation for cataract. Brit. Jour. Ophth., 1942, v. 26, p. 93.

Davis, F. A. Intracapsular cataract extraction. Arch. of Ophth., 1944, v. 31, p. 367.

[4] Lagrange, H., and Lacosta, A. Des complications subaigues et tardives après l'opération de la cataracte. Arch. d'Opht., 1911, v. 31, p. 769.

Straube, M. Over Outslekingen door Oplossing Van Lenamassa. Amsterdam, 1919. Quoted by Nugent, O. B.: Endophthalmitis phacogenetica. Amer. Jour. Ophth., 1926, v. 9, p. 680.

Gifford, S. R., and Steinberg, A. A. Allergic and toxic properties of lens protein. Jour. Amer. Med. Assoc., 1925, v. 85, p. 351.

[5] Verhoeff, F. H., and Lemoine, A. N. Endophthalmitis phaco-anaphylactica. Trans. Internat. Congr. Ophth., 1922, p. 234.

[6] Verhoeff, F. H., and Lemoine, A. N. Ref. 5.

Lemoine, A. N., and MacDonald, A. E. Observation on phacoanaphylactic endophthalmitis. Arch. of Ophth., 1924, v. 53, p. 101.

Gifford, S. R., and Steinberg, A. A. Ref. 4.

Goodman, 1932. Quoted by Buxton, R. Brit. Jour. Ophth., 1939, v. 23, p. 505.

Hughes, W. F., Jr., and Owens, W. C. Unpublished figures on 46 cases, 1944.

[7] Burky, E. L., and Henton, H. C. Staphylococcus toxin combined with lens extract as a desensitizing agent in individuals with a cutaneous sensitivity to lens extract. Amer. Jour. Ophth., 1936, v. 19, p. 782.

[8] Berens, C., and Bogart, D. Certain post-operative complications of cataract operations. Trans. Sect. Ophth., Amer. Med. Assoc., 1938, p. 238.

REPAIR FOLLOWING TUCKING OPERATIONS ON THE EXTRAOCULAR MUSCLES*

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Since the early part of nineteenth century many articles have appeared in the literature concerning operations on the extraocular muscles for strabismus. But, so far as can be ascertained, only two papers have been published on the study of repair following such operations. The first systematic attempt to study this problem was apparently made by Carroll and Blake.[1] Since then Gifford[2] has observed the position of extraocular muscles after operations for strabismus.

In the study of repair following operations on the extraocular muscles Carroll and Blake used adult rabbits as the experimental animals. For anesthesia they used sodium amytal or pentobarbital sodium intraperitoneally. They used ingenious methods to hold the animal in a suitable position from which it could not move. The animals were killed 2 to 40 days after the operation by electrocution or ether. The following operations were performed on the rabbits' muscles: simple tenotomy, attachment of the muscles to the sclera by sutures, tucking, and resection.

Chouké and Whitehead[3] have shown that healing of skeletal muscle of dogs and rats occurs by fibrous connective-tissue growth from the epi-, peri-, and endomysium, and not through regeneration of muscle cells. They also found that the union of muscle to muscle is complete 8 to 11 days after suture.

The experiments here reported were performed on dogs to see whether the repair following operations on extraocular muscles was similar to or different from the results obtained in the case of rabbits by Carroll and Blake. Another object of these experiments was to compare the repair of extraocular muscles with the repair of skeletal muscle in general, since Irvine[4] has shown that many peculiarities distinguish the ocular from other striated muscles, both in man and in lower animals. Embryologically, in man, there is a possibility of splanchnic origin for the ocular muscles, according to Irvine. Histologically, ocular muscles differ from skeletal muscle in having unusually fine fibers, excessive amounts of elastic tissue, unusual fibers with encircling fibrillae, fibers rich in sarcoplasm, and others with interlacing fibrillae. This picture is somewhat similar to that seen in degenerating muscle in myxedema and various myopathies.

From an anatomic point of view the extrinsic ocular neuro-muscular structure of man is differentiated earlier in the phylogenetic history than the striated musculature elsewhere in the body. A good historical account of muscle tucking is given by Burch and Grant.[5, 6] Therefore it will not be repeated here.

The results of simple tenotomy, attachment of the muscles to the sclera by sutures, and resection obtained by Carroll and Blake have been confirmed by Gifford. Only two tenotomies were performed on dogs by the present writer. One of these was accidental, for the animal was physically so weak that while the tucking operation was being completed,

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the muscle broke in two almost at its center; it should probably therefore be called a myotomy. The other was intentional and was performed practically in the same manner as simple tenotomy is done for human cases of strabismus. The results of both these operations were for all practical purposes identical with those of Carroll and Blake on the rabbits and those of Gifford on the human eye. In other words, the muscle was found attached to the sclera behind the original insertion in the case of the intentional tenotomy. This animal was killed 28 days after the operation. But in the case of the accidental myotomy the attachment of the proximal end of the muscle could not be definitely established. As stated, the physical condition of this animal was very poor; this may possibly account for no definitely visible gross attachment of the muscle to the sclera. Even though the animal was kept alive for 120 days after the operation, its general physical condition did not show any improvement. Since the results of the operations on these two dogs agreed with those of Carroll and Blake and of Gifford, no further simple tenotomies were performed.

Extraocular muscles were subjected to 38 tucking operations in a series of 20 adult dogs. The experimental animals, as has been mentioned, were all adult dogs. They varied in weight from 7 to 19 kilograms. The animals were killed from 1 to 155 days after the operation by chloroform or ether, excepting one which was bled to death under sodium amytal anesthesia, since its blood was needed for an experiment connected with a war problem. Sodium amytal, 15 mg. per cubic centimeter per kilogram of body weight, was injected intraperitoneally. In a few cases toward the end of the operation a few whiffs of ether were given to keep the animal quiet. In six animals sodium amytal, 10 mg. per cubic centimeter per kilogram of body weight, was injected intravenously; the results of this method of anesthesia were at least as satisfactory, if not more so, as the intraperitoneal method. The animal was ready for operation in less than 10 minutes after the intravenous injection of sodium amytal, thus proving the latter to be a time-saving procedure. There was only one death in this series that could be attributed directly to an overdose of anesthetic. Two other animals died within 24 hours after the operation; no definite cause of death, however, could be established.

Thirty-eight tucking operations were performed involving either the lateral rectus or the superior rectus muscle. The instrument employed was in some cases Todd's tucker; in others Harrison's or Speas's tucker was used. In a few cases a tuck was placed with a Roberts tucker in the muscle at a distance of 3 to 8 mm. from its insertion, two single silk sutures being used.

Results

Gross. All wounds appeared to be completely healed within 12 days after the operation. Black-silk sutures could be seen easily, thus marking the site of the tuck. The tuck in all cases was covered over by connective tissue. The union appeared to be as firm as in the normal attachment of extraocular muscles to the sclera. In other words, the muscle with a tuck could stand as much pull on it as a normal undisturbed extraocular muscle. In several animals the muscles were seen to be attached to the sclera at or near the point of the tuck. In four cases the two ends of the muscle on either side of the tuck responded to electrical stimulation. A definite twitching of the muscle could be seen after the application of a double fine electrode to either end of the muscle.

Microscopic. Twenty-four to 48 hours after the operation a definite foreign-body reaction had started near the site of the suture. About the fourth postoperative day some of the muscle fibers in the tuck were seen to be disintegrating. Many young fibroblasts, some polymorphonuclear cells, a few small round cells, and a very small amount of fibrin were noted. Probably these conditions were caused by the trauma to the muscle.

On the seventh postoperative day there was seen a dense cellular reaction consisting mainly of small and large mononuclear cells. Many fibroblasts and round cells were also seen in addition to some granulation tissue among the muscle fibers.

By the twelfth postoperative day there was a larger amount of fibrous connective tissue replacing the muscle fibers. Foreign-body reaction and granulation tissue were still present. Union of the muscle to the sclera was visible in the region of the tuck in addition to the union between the two parts of the muscle to each other. The appearance of the sections on the sixteenth postoperative day was practically the same as that for the twelfth postoperative day.

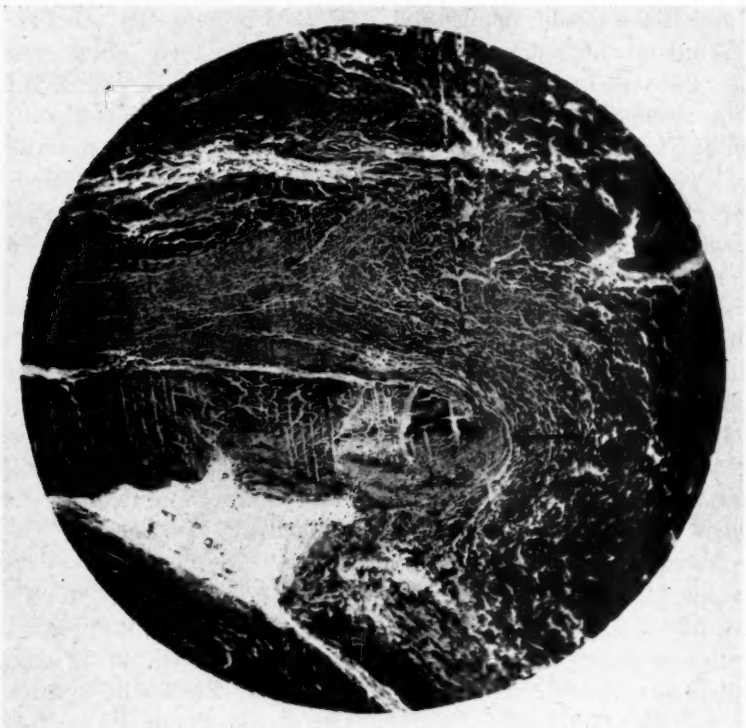

Fig. 1 (Chouké). Results of tucking on the nineteenth day. The loop of the muscle is shown in this figure in addition to the attachment of the muscle to the sclera (see arrows). H and E stain; ×50.

On the nineteenth postoperative day there was some foreign-body reaction around the silk sutures. In the photomicrograph of a section taken on the nineteenth postoperative day (fig. 1) a loop of the muscle and its attachment to

the sclera can be seen, with slight cellular reaction. Necrotic fibers of the muscle mentioned under the fourth postoperative day are not seen at this stage; apparently they have been absorbed.

On the twenty-eighth postoperative day some muscle fibers have been replaced by scar tissue. Foreign-body reaction is still present around the silk sutures.

On the thirtieth postoperative day a complete loop of the muscle can be seen. Its attachment to the sclera is also visible. There is a noticeably small amount of scar tissue in this section (fig. 2), except at the junction of the muscle with the sclera.

On the thirty-fifth postoperative day the tuck is seen in the center and the muscle on either side of the tuck is connected by fibrous connective-tissue scar (fig. 3). Two silk sutures are still present. Under the suture on the left side of the figure attachment of the muscle to the sclera can be seen. Adjacent to the right suture some foreign-body reaction is still present.

Fig. 2 (Chouké). Results of tucking on the thirtieth day. Complete loop of the lateral rectus muscle is seen. The lower part of the figure shows the attachment of the muscle to the sclera. H and E stain; ×50.

During the period between the 35th and 155th postoperative days there is hardly any noticeable difference in the gross picture or in the microscopic appearance of the tissues.

The muscle attachment was accomplished by organization of fibrin and by granulation tissue. Carroll and Blake[7] also express the same opinion in the following words: "In tucking and resection, the

end result depends upon a bridge of strong connective tissue uniting the loops of the tuck, or the severed parts of the muscle. Occasionally the muscle becomes attached at some distance from the desired point." These observations seem to agree with the statement of Gifford: "It would appear from these findings that necrosis of muscle fibers would actually shorten the muscle more than the calculated amount while the amount of relaxation of the muscle due to the formation of granulation tissue was a variable quantity."[2] He also found some adhesions between muscle and sclera 3 to 4 mm. posterior to the tuck. This is quite in agreement with the present observations noted above under the twelfth postoperative day findings. According to him: "Such adhesions might be expected to neutralize completely the effect of the tuck and possibly to limit motion in the field of the muscle." This comment by Gifford is significant and may explain, at least partially, the reasons for performing fewer and fewer tucking operations for strabismus by ophthalmic surgeons in different parts of this country.

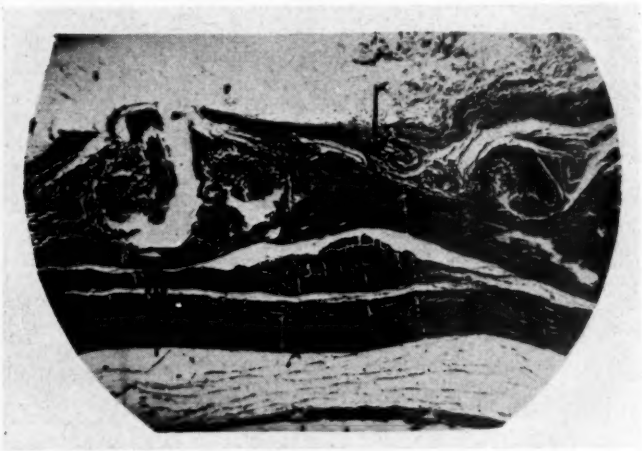

Fig. 3 (Chouké). Results of tucking on the thirty-fifth day. The tuck is seen in the center and the muscle on either side of the tuck connected by fibrous connective tissue. Under the left suture, attachment of the muscle to the sclera can be seen. H and E stain; ×25.

Summary

After a tucking operation the two adjacent sides of the loop of muscle join together by means of fibrous connective tissue. The side of the muscle nearest the eyeball quite often, but not always, becomes attached to the sclera by fibrous connective tissue. The process of repair of extraocular muscles in the dog is essentially similar to that of the skeletal muscles elsewhere in the body. The time required for the completion of repair of extraocular muscles is slightly longer than that for general skeletal muscles of the same animal. The continuity of the muscle is preserved after the tucking operation, as evidenced by response to electrical stimulation.

The writer gratefully acknowledges the preparation of the microscopic sections by the Harrison Department of Research Surgery, University of Pennsylvania, under the direction of Dr. I. S. Ravdin.

References

[1] Carroll, F. D., and Blake, E. M. Repair following operations on extra-ocular muscles: Histologic observations. Arch. of Ophth., 1932, v. 8, April, pp. 711-726.

[2] Gifford, S. R. Position of muscles after operation for strabismus. Arch. of Ophth., 1942, v. 27, March, pp. 443-459.

[3] Chouké, K. S., and Whitehead, R. W. Wound healing: with especial reference to muscle and fascia repair. Surgery, 1941, v. 9, Feb., pp. 194-197.

[4] Irvine, S. R. Histology of the extra-ocular muscles. Arch. of Ophth., 1936, v. 15, May, pp. 847-858.

[5] Burch, F. E., and Grant, H. W. Some considerations of muscle surgery, with special reference to the tucking method. Trans. of Amer. Acad. Ophth. and Otolaryng., 1930, v. 35, pp. 63-82.

[6] ——. Some considerations of muscle surgery, with special reference to the tucking method. Amer. Jour. Ophth., 1931, v. 14, June, pp. 489-497.

[7] Carroll, F. D., and Blake, E. M. Repair following operations on extra-ocular muscles: Histologic observations. Abstract. Amer. Jour. Ophth., 1933, v. 16, pp. 167-168.

CORNEAL DYSTROPHIES

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Chicago 2

There has been much confusion in the ophthalmic literature in the description and classification of hereditary corneal dystrophies during the past 50 years.[1] Within the past decade Buecklers[2] initiated a first step toward an orderly classification by isolating three main clinically separate types. Twelve family groups consisting of 800 living in 35 small communities in Wuerttemberg were examined by Buecklers and his associate Gilch. Among these were 119 individuals presenting the three morphologically different types.

Buecklers's triad

1. *Dystrophia corneae granulosa (Fleischer's type), "broeckelige," granular-disc form.* This type may begin as early as the fifth year and progresses slowly until the thirtieth or fortieth year. Two family groups included 68 cases, showing dominance in heredity. The changes in this type are within a central disciform area. There is a clear marginal border. The individual lesions resemble dried bread crumbs in form. The slitlamp shows the opacities in the areas of the interlamellar cement substance with no preference as to depth. The epithelium is rarely involved. However, I saw a case in 1925, which presented added superficial, definitely circinate lesions. I have seen a three-case group of a mother and two daughters. An interesting case of this type has been under my constant observation for over 20 years. The patient is now 50 years old. During this period, because of slow progression of the lesion, the vision dropped from 20/80 to 12/200. Castroviejo, 6½ years ago, performed a corneal transplant in this case. This granular disciform type is the most common among hereditary dystrophies. Buecklers in 1938 reported a histologic examination, and his conclusion was that the granular substance was a keratohyalin originating *in situ.*

2. *Dystrophia corneae reticulata (Haab-Dimmer type), "gittrige," lattice.* In 1898 Haab and Dimmer described the well-known lattice form of corneal dystrophy. It is composed of irregular double-contoured lines, often split at their ends.

They are in part superficial and glassy in character. In some of the cases which I have seen, there seemed to be a relative sparing of the pupillary area in the incipience.

I have seen three cases in one family at the Illinois Eye and Ear Infirmary, and two cases of a family group of father and five of eight adult siblings involved. Therefore, this type is dominantly hereditary. In the first three cases in one family the lesions were all large and coarse. In the second group the lines were faint and dainty in contour. These cases were sent to me for contact-glass trial. The vision in one eye was improvable from 20/120 with glasses to 20/30−3 with a contact glass. The patient was impressed, but not interested.

3. *Dystrophia corneae maculosa (Groenouw type), fleckige-knötchenförmige, spotted, at times nodular.* Groenouw first described a granular dystrophy in 1890 which later became known as the Fleischer type. During the same year he also described a spotted nodular type which bears his name. This initiated some of the confusion in the literature. These two types, the granular and nodular, were for some time designated as Groenouw type 1, and type 2 in European literature. In the Groenouw dystrophy the lesions begin early in the second decade of life as a diffuse spotting composed of faint, more or less rounded, superficial and deep cloudings. These extend to the limbus. They increase in number and density and later may become elevated and nodular, and by their interference may lead to practical blindness in old age. From his study Buecklers thinks the heredity is recessive. Family groups are not frequently found. I have seen only a few well-advanced cases of Groenouw dystrophy, more of moderate involvement.

Buecklers believes that each of these three types of corneal hereditary dystrophy presents a definite clinical entity. He suggests that the term "familial dystrophy" as a description of all types be abandoned. Latin names were evolved descriptive of the three clinical types. The terms *granulosa, maculosa,* and *reticulata* were adopted in the Buecklers monograph.

Fuchs's epithelial dystrophy

This condition presents a chronic edema of the epithelium especially of the central corneal area. The cells are swollen and there may be droplets between them giving the appearance of glassy beads. It is similar to the slitlamp picture we see in glaucoma when the eyeball is under high tension. In old cases of Fuchs's dystrophy and in old glaucomatous eyes the epithelium develops a chronic degenerative vacuole formation. In Fuchs's dystrophy the central corneal epithelium presents this change because of the stromal imbibition of water derived from the aqueous. The great majority of epithelial dystrophies are secondary, owing to a senile cornea guttata. In these cases clear elevated humps protrude from the back of Descemet's membrane (Hassal-Henle Descemeti warts.) These humps elevate the endothelial cells. The raised endothelium is thus exposed to the trauma of the convection current within the anterior chamber. These elevated cells gradually degenerate. They lose their physiologic-barrier function, which normally keeps the aqueous from infiltrating into the corneal stroma. Pigment in the aqueous often attaches itself to this roughened, middle-posterior corneal surface.

A moderate amount of Hassal-Henle warts in the corneal center are a common senile slitlamp finding. When this formation becomes very pronounced the quite rare condition of Fuchs's epithelial dystrophy develops. There is no hyper-

tension. A few cases of Fuchs's epithelial dystrophy have been seen, with no visible endothelial changes or cornea guttata. These may present some as yet unknown dysfunction of the endothelial barrier. Meesmann has seen cases dominantly hereditary in which the endothelium appeared normal. This is difficult of determination, for the epithelial edema obscures the picture.

Salzmann's nodular dystrophy

This type of dystrophy was first reported in 1925. It differs from Groenouw's in that the lesions are fewer and there is a vascularization. Vogt calls a similar condition keratitis tuberosa, and shows a typical case in his Atlas. The vascularization surrounds the nodules, but does not invade them. This is also shown in the illustrations of cases reported by E. V. L. Brown and Dewey Katz. Characteristic old corneal scars following phlyctenulosis are usually found in the same patient.

Five out of the 23 cases first reported by Salzmann were bilateral.

I have a kodachrome of a Salzmann nodular dystrophy in a man, aged 58 years, whom I saw over a year ago at Rush Medical Clinic. The patient was sent from the County Hospital. The condition was unilateral. There was a group of large elevated nodules. There was no vascularization, nor were there evidences of old phlyctenular lesions. In this it resembled an advanced case of Groenouw's nodular dystrophy and could be so diagnosed, if it had been bilateral.

Keratoconus

Keratoconus is a corneal dystrophy, due to the development of a congenitally ordained central stromal weakness. The common lesions, conus formation, apical reflex, Fleischer's ring, Vogt stripes, superficial scar formation, and rupture in Descemet's membrane (the latter in only very advanced cases), are all due to the mechanical distortion incidental to the conus development. The clinical picture is well known.

I have a first edition of a book, probably the first one ever published concerning the cornea, entitled—"A treatise of the diseases of the horny coat of the eye," by Benedict Duddell, surgeon and oculist, published in London, in 1729. On page 32 there is given the first authentic description of conical cornea in the following words:

> I saw a poor Boy at Hammersmith, that was blind of one Eye from Abscesses that had mined through the Blades of the Horney-Coat; and the Cicatrices following made a great Opacity, which hinder'd the Rays from Passing through the Coat. The cornea of his other Eye was swell'd out towards his Nose to the Bigness of half a Pea, and was transparent in the swell'd Part; the other Part of the Cornea was opake; he cou'd see very well on that Side of his Eye next to his Nose.

References

[1] Von der Heydt, Robert. Corneal dystrophies (Types). Amer. Jour. Ophth., 1937, July.
[2] Buecklers, Max. Die erblichen Hornhautdystrophien. Klin. M. f. Augenh., Beiheft, 1938.

DEFINITION OF ANOMALOUS RETINAL CORRESPONDENCE*

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In a recent article on ocular terminology, Lancaster,[1] speaking for the American Committee on Optics and Visual Physiology, presented definitions† of anomalous retinal correspondence and related phenomena. One definition described an anomalous retinal correspondence as a condition in which the fovea of one retina and an eccentric element of the other acquired a common visual direction; that is, became corresponding retinal points. A review of the literature reveals this simple definition to be in common usage. Unfortunately, such a functional relationship between the fovea of the fixating eye and a peripheral retinal area in the squinting eye can be demonstrated in few patients with anomalous retinal correspondence. Moreover, attempts to use the definition as a criterion for diagnosis have misled some ophthalmologists to believe the anomaly rare. This fact is exemplified by a comparison of 100 cases of esotropia selected at random from admissions to the State University of Iowa Clinics in 1935 with 100 consecutive cases admitted in 1942. Of the 1935 group, only three were suspected of having some anomaly of correspondence, whereas a definite diagnosis of anomalous retinal correspondence was made in 73 percent of the 1942 group. New criteria for diagnosis and improved methods of examination account for the discrepancy rather than does an increased incidence of the anomaly. In 1935, the orthoptist used an illuminated Brewster-Holmes type of prism stereoscope so adjusted that when one target was fixated by the fovea of the nonsquinting eye, the other target stimulated that peripheral retinal area of the squinting eye which, according to the aforementioned definition, could become a functionally corresponding point. Correspondence was considered abnormal only if the two objects

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† *Corresponding points:* Points on the two retinas which have the same relative directional spatial value. For every point on the retina of one eye (except for the temporal crescent of each uniocular field which is not included in the binocular field of vision, and except for the blind spot), there is a point on the retina of the other eye, stimulation of which gives the same sensation of direction. The foveas are the corresponding points *par excellence.*

Retinal correspondence is not an anatomic peculiarity innate and unchangeable. In squint, *anomalous correspondence* frequently develops. In this condition a different point of the retina of the squinting eye acquires a more or less perfect correspondence with a point of the nonsquinting eye. This is *secondary correspondence,* or anomalous correspondence. Another definition: If elements of the two retinas—for example, the fovea of one and an eccentric element of the other retina—acquire a common visual direction, this new sensorial relationship is termed anomalous or secondary.

Angle of anomaly (Bielschowsky), *angle of adaptation* (Chavasse). When an eye has deviated a long time, a certain amount of adaptation may take place. The fovea of one eye no longer has the same directional value as the fovea of the other eye, but instead some peripheral point of the retina of the deviating eye acquires a directional value corresponding to the fovea of the fixating eye. This is secondary or anomalous correspondence. The angle between the line of direction of the fovea and the line of direction of this new point, which corresponds in directional value with the fovea of the other eye, is the angle of adaptation or the angle of anomaly.

Harmonious correspondence. If the angle of anomaly or of adaptation is equal to the angle of deviation, the secondary correspondence (anomalous correspondence) is called harmonious. The point of the retina of the deviating eye on which the image of the point of fixation falls is the point that has acquired correspondence with the fovea of the fixating eye. Sometimes (often) it is not this point but some point between it and the fovea that corresponds with the fovea of the fixating eye. Then the correspondence is subharmonious (Chavasse).

were perceived as superimposed; a finding that was rarely recorded. The fallacy of the test and consequently of the definition became evident when determination of the field of binocular vision became a routine procedure.

Several methods were used to plot the field of vision of the squinting eye while the patient maintained fixation and a full field of vision in the other eye. In one method, a mirror placed before the fixating eye separated the fields of vision. While this eye fixated a centrally placed target on one tangent screen, the field of vision of the squinting eye was plotted with 1- to 5-mm. white targets on a separate unmarked screen at distances of one to two meters. In another method, colored filters were used to separate the fields of vision of the two eyes. A red filter was placed before the fixating eye, and for fixation a small red disc of light was projected upon an unmarked white wall at distances of two to six meters. A green filter was placed before the squinting eye, and a tiny green disc of light was projected on the screen at various positions to plot the field of vision of the squinting eye. The patient was required to distinguish only the presence of the peripheral image, not its green color. The stereocampimeter provided a third method of examination.

With all methods it seemed that, in accordance with the findings of Travers,[2] the point of fixation was perceived only by the fixating eye in almost all cases of untreated nonparalytic esotropia. For example, patients with anomalous retinal correspondence described the target presented to the squinting eye as approaching the point of fixation, disappearing, and then reappearing on the opposite side. Rarely was the target described to be superimposed on the fixation point. This finding made evident the fallacy of applying the aforementioned definition to the diagnosis of anomalous correspondence. How could the fovea of the fixating eye become a functionally corresponding point with a suppressed retinal area in the squinting eye?

Verhoeff[3] believes that both eyes, and particularly the two foveas, are habitually used simultaneously by squinters who are free from amblyopia. In almost every case of esotropia the field of vision showed some degree of suppression of the macular region of the squinting eye; however, excluding those patients with extramacular fixation and a large absolute central scotoma in the monocular field of vision, the macular region was found to retain a relatively high degree of form sense (equivalent to 5/60 to 6/21). Moreover, it was usually possible to demonstrate whether or not this partially suppressed macular area of the squinting eye retained the same visual direction as the macular region of the fixating eye. If objects were presented simultaneously to both maculas, the patient with esotropia and anomalous retinal correspondence had crossed diplopia with images separated by an angle approximating or slightly less than that of the squint; with normal correspondence, the images were superimposed. A number of tests for anomalous correspondence have been applied on this basis; for example, the afterimage test of Tschermak.[4] All are so devised that when the macular regions are stimulated simultaneously, the patient is able to distinguish between the images of the two eyes and to visualize their relative visual directions. In recent years three methods of determining retinal correspondence have been used in the Iowa Clinic: afterimages, stereoscopic devices, and a projection system with color or polaroid filters.

These three types of tests do not always agree, but this is not an indication that one or the other test is incorrect or that the criterion for diagnosis is inadequate; rather it is an indication that correspond-

ence is variable. The abnormal relationship between the central retinal areas of the two eyes often is fixed at a constant angle (angle of anomaly), but in some patients, particularly those who have received treatment, it may be variable or even absent, depending upon the circumstances under which the test is performed. For example, in monocular squints it is not rare to find normal correspondence when the usually squinting eye is forced to fixate, but anomalous correspondence under other conditions. The correspondence also may vary with the intensity of the stimulus and the total area of the retina stimulated. Finally, anomalous and normal retinal correspondence frequently coexist in patients receiving treatment; that is, monocular diplopia in the squinting eye. This variability becomes evident only when more than one type of test is used routinely. It is one of the important characteristics of anomalous correspondence.

Anomalous correspondence tends to adapt itself to the deviation of the squinting eye. This fact is important, for it is another prevalent concept that simple changing of the deviation of the eyes by muscle surgery constitutes effective treatment. In the author's experience, this concept is erroneous. Several years ago nearly 100 esotropias with abnormal correspondence were corrected to within a few degrees of orthophoria by surgery. After a period of two to four months, the large angle of anomaly had disappeared in the majority of cases, but it was seldom possible to demonstrate fusion* developing either spontaneously or after intensive orthoptic exercises. The failure to establish true fusion in most of these patients was explained when they were reëxamined and especial care was used to stimulate exactly the foveal regions. Anomalous correspondence with variable angle of anomaly of only a few degrees was repeatedly demonstrated. Moreover, it was exceedingly difficult to establish normal correspondence in these patients by orthoptics; the angle of anomaly was so small that it was practically impossible to adjust any instrument to stimulate simultaneously the desired retinal areas without at the same time stimulating the anomalously related areas. Prolonged occlusion (4 to 12 months) was also unsuccessful. Repeated examinations made during the past five years with an additional control group of 100 patients with abnormal correspondence treated surgically without orthoptics or occlusion provided further evidence that anomalous retinal correspondence tends to adapt itself to the deviation of the eyes; that is, a new variable angle of anomaly approximating the deviation of the eyes develops over a period of months. Therefore, when surgery is performed as an initial procedure in patients with anomalous retinal correspondence, immediate and intensive postoperative orthoptic exercises are desirable to establish normal correspondence and fusion before the anomalous correspondence *adapts itself to the new deviation.*

Pugh[5] has advocated the therapy outlined; that is, surgery followed immediately by intensive orthoptic training. The writer has found it more expedient to utilize another characteristic of anomalous correspondence; that is, its instability with disuse. Not infrequently the anomaly is disrupted by occlusion of one eye for several months. Prolonged occlusion is an essential first step in some cases, and in all instances shortens the period of supervised orthoptic training. Dicke[6] has also advocated a program utilizing preoperative occlusion.

Discussion

Perhaps a definition of anomalous retinal correspondence need only include a correct example of the anomaly; for ex-

* Maddox Grade II.

ample, the definition of Bielschowsky[7]: "The foveal images of the two eyes are not localized as in cases with normal correspondence in one and the same visual direction, but in different directions coinciding with the geometrical (foveal) lines of direction." However, mistakes such as those described will be generally fewer if the definition includes those outstanding characteristics of the anomaly which must be understood for proper diagnosis and treatment.

Objections to the definition in common use are summarized, and a new definition is presented including those characteristics that in the writer's experience are essential to proper diagnosis and treatment of anomalous retinal correspondence. Possibly there are other characteristics that should be included.

Summary and Conclusions

The prevalent definition of abnormal retinal correspondence as an anomaly in which the fovea of the fixating eye and a peripheral retinal area in the squinting eye become functionally corresponding points seems erroneous. Studies of the field of binocular vision reveal that the peripheral retinal area in question is almost invariably suppressed.

Unless there is a high degree of amblyopia the macular region of the squinting eye is only partially suppressed; consequently, demonstration that the foveal or macular regions of the two eyes are not corresponding points provides a practical method of diagnosing anomalous retinal correspondence in the great majority of patients. Afterimages, stereoscopic devices, or a filter projection system may be utilized to stimulate the macular regions and to determine their relative visual directions.

Anomalous retinal correspondence is not necessarily fixed at a constant angle of anomaly, but is frequently variable and tends to adapt itself to the deviation of the eyes. Experience with several hundred cases indicates that instead of completely disrupting abnormal retinal correspondence, muscle surgery alone usually results in a gradual change in the angle of anomaly to correspond with the new deviation.

Another characteristic of anomalous retinal correspondence is that it becomes unstable with disuse; that is, disruption of binocular vision. Prolonged monocular occlusion is an important adjunct in treatment of the anomaly.

In accordance with these findings, anomalous retinal correspondence is defined as an anomaly of binocular vision in which areas in the two retinas normally having a common visual direction—for example, the foveas—acquire an unstable and often variable visual direction in relation to each other but usually in accordance with the squinting position. The anomaly is always associated with some degree of suppression of the squinting eye, the point of fixation almost invariably being viewed monocularly.

References

[1] Lancaster, W. B. Terminology in ocular motility and allied subjects. Amer. Jour. Ophth., 1943, v. 26, pp. 122-132.

[2] Travers, T. a'B. The origin of abnormal retinal correspondence. Brit. Jour. Ophth., 1940, v. 24, pp. 58-64.

[3] Verhoeff, F. H. Anomalous projection and other visual phenomena associated with strabismus. Arch. of Ophth., 1938, v. 19, pp. 663-699.

[4] Tschermak. Ueber anomale Sehrichtungsgemeinschaft der Netzhäute bei einem Schielenden. v. Graefes Arch. f. Ophth., 1899, v. 47, p. 508.

[5] Pugh, M. A. Treatment of squint and heterophoria. Modern trends in ophthalmology. New York, Paul B. Hoeber, 1940, pp. 298-307.

[6] Dicke, D. E. Anomalous retinal correspondence. Amer. Jour. Ophth., 1942, v. 25, pp. 585-587.

[7] Bielschowsky, Alfred. Lectures on motor anomalies. Dartmouth College Publications, Hanover, N.H., 1940, p. 42.

THE USE OF CHOLINE IN CASES OF ULCER AND OF LEUKOMA OF THE CORNEA*

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It may be that in the early days of medicine the term *cataract* was applied to any obscuration of vision, even to pathologic change in the innermost layers of the retina. The word *cataract* is derived from the Greek kata, down, and arassein, to fall. Anything that fell over and in front of the percipient elements of vision was to the people of that time a cataract.

In this more enlightened age we have appropriated the word to designate a pathologic condition of the crystalline lens. It is not unusual for even cultured individuals, those in the habit of analyzing words, to become confused when the word is applied to a particular pathologic state, for individuals forget that words are only arbitrary.

The subject of this contribution concerns the white cicatrices of the cornea and the ulcer responsible for such scars. It is desired to show that these ulcers can be aborted and that the agent used to this end can also be adopted to treat the scar that the ulcer leaves. It might have been preferable to present for consideration merely the bare facts and the simple demonstration and to leave speculation to the reader; however, it is not entirely possible to do so. The subject of choline must be treated somewhat more fully.

We appreciate the fact that scars of the cornea often diminsh from childhood to adult life and that it is possible for man to imitate senescence in a scar and thereby reduce its size. How this is done is usually a matter of speculation. We hope to demonstrate the action of choline on such scars.

Long ago bile was instilled into the eye to affect scars of this kind. We submit that a constituent of bile is the agent that induces the amelioration. Although bile contains but a small amount of this constituent—namely, choline—we are of the opinion that it may be the factor that accomplishes the desired results.

Choline will, in a remarkable manner, cleanse a moderate-sized corneal ulcer of pus, leaving the floor of the ulcer clear. Should the ulcer penetrate the cornea and there be pus in the anterior chamber of the eye—limited, however; not a panophthalmitis—choline will find the channel and search out the pus without injuring the tissues. Its performance is uncanny. Choline dissolves fibrin. It will "turn over" lipoids and cholesterol esters in cases of corneal leukoma, reducing the size of the leukoma.

We are not concerned here with determining whether choline is or is not, constitutionally, a vitamin, a vitagen, a hormone, or an enzyme; whether it is antihemorrhagic, lipotropic or what its effect on cholestrol esters is; we are interested in the fact that when applied topically to an ulcer of the cornea the pus is purged; when applied to a leukoma the cicatricial disfiguration is reduced. We have treated numerous ulcers of the cornea sufficiently to convince ourselves of its effect.

In the treatment of leukoma the results are most encouraging, but less spectacular than in the case of ulcers. We first test with fluorescein to discover if there is epithelial abrasion. Usually there is not.

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Then choline is instilled, followed by another test with fluorescein. The epithelium for the second time does not stain. However, the periphery of the leukoma does. In view of this evidence we conclude that choline has the power to penetrate the epithelium of the cornea and enter the corneal stroma. At first the direction of penetration is like ripples about the lesion, the action to be expected from a wetting agent; secondly, choline penetrates into the anterior chamber of the eye, the action one would expect from a polar, nonpolar chemical. If the lesion extends to the lens the course of the pathologic process will stain; however, we have not as yet been able to stain vitreous opacities. We have flooded the anterior chamber with a 1-percent solution of choline and without injuring the tissues.

Lipoids and cholesterol esters in scars of the eyes have been accorded very little attention in the past. Yet they are, in our opinion, of great importance in maintaining persistence of disease. Mustard-gas lesions of the cornea are an example of an irritation maintained by lipoids and cholesterol crystals. Choline changes lipoids into phospholipoids. The latter can be readily removed from the lesion and this is probably true of cholesterol esters also.

The action of choline upon pus will not be discussed here except to state its purging effect. It will liquefy pus in the test tube as well as fibrin and other substances.

Many chemicals have been applied to leukomas to reduce their size, but few have merit. Dionin is one of these. It is not lipotropic; choline is. Histologically, scars have been carefully studied, but only as static tissues; not as lesions in a functioning organ of multiple chemical processes in which there is incessant change. One does not question the exact studies of the pathologist as regards static tissues, but his studies of lipoids and cholesterols in these tissues are not so careful; in fact, he destroys them.

The properties of choline, chemically, biochemically, and physiochemically, are deserving of attention.

Choline was probably first isolated fully 100 years ago, the original source being from the lecithin of liver secretion. It is a simple natural organic base and its chemical formula is as follows: $C_5H_{15}NO_2$, with a molecular weight of 121.13. It has a white color and a fishy odor. Synthetically it may be obtained by treating an aqueous solution of trimethylamine with ethyline oxide.

$$(CH3)_3N + Cl\,CH_2\cdot CH_2\cdot OH \rightarrow$$

Trimethyl Amine — Ethylene Chlorhydrin

$$\rightarrow Cl\,(CH_3)_3N\cdot CH_2CH_2\cdot OH$$

Trimethyl-B-hydroxyethyl Ammonia chloride
Choline chloride

Choline is a strong base liberating ammonia from its salts and precipitating as hydroxide (from aqueous solution) the salts of the heavy metals. Its solution dissolves fibrin and prevents the coagulation of proteins. It appears that choline is involved in the metabolism of cholesterol as well as in that of the neutral fats.

Physiochemically, it is one of the most remarkable penetrating agents. Its molecule is both polar and nonpolar, and is soluble in either water or oil. It will readily combine with other drugs and staining agents and carry them deep into the tissues.

Summary

Choline is a most promising agent in the treatment of ulcers of the cornea and of leukoma of the cornea. It should be applied topically in such conditions.

NOTES, CASES, INSTRUMENTS

INTRAOCULAR INJECTION OF PENICILLIN IN A CASE OF RING ABSCESS OF THE CORNEA

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Ring abscess of the cornea has always been a disease characterized by a poor prognosis and usually has resulted in perforation of the cornea with loss of the eye. The excellent results obtained by the use of penicillin injected into the anterior chamber and associated sulfadiazine therapy warrants the recording of this case of ring abscess.

CASE REPORT

D. G., a woman, aged 29 years, was first seen at the Boston City Hospital Emergency Floor on January 23, 1944, complaining of photophobia, lacrimation, and pain in the right eye. The patient stated that on the previous day a foreign body had been removed from the corneal area by the use of a "clean handkerchief." On examination, a small localized ulceration was observed on the right cornea, with associated ciliary and conjunctival injection. No foreign body was present. Local therapy of warm boric-acid-solution compresses, White's ophthalmic ointment with 1-percent atropine, and a sterile dressing was advised.

On January 24th the patient reported to the Out-Patient Department with markedly increased severity of her symptoms. An ulceration, measuring 3 by 5 mm., with deep infiltration was found at the 3-o'clock position. Moderate ciliary congestion existed, and the iris was fully dilated. Tension was palpably soft, with slight deep tenderness. Visual acuity at the time was O.D. 20/40, O.S. 20/30. The previously advised therapy was continued, the applications to be made at more frequent intervals.

Two days later the patient was seen in the Out-Patient Department. The ocular condition was found to be alarming, and admission to the Hospital was advised. A culture and smear of the cul-de-sac of the right eye were taken at 9:00 A.M. and later proved to be B. pyocyaneus and hemolytic Staphylococcus aureus.

Physical examination. The patient had an oral temperature of 101; pulse of 95, and respirations of 20 per minute. She was flushed and complained of chilliness. General physical examination revealed no other abnormalities; her blood pressure was 120/80.

Right eye. Erythema and slight edema of both lids were present, together with an almond-sized, tender, preauricular lymph node. Lacrimation and purulent exudate were profuse. No material was expressed from the lacrimal sac. The ciliary and bulbar conjunctival injection was intense and diffuse. There was no elevation of tension to fingers, but ocular tenderness was present. The cornea was opaque in its entire central area; a small rim of clear cornea approximately 2 to 3 mm. in width persisted between the lesion and the limbus. The clear area became narrower toward the nasal half of the cornea at the site of the original lesion. The involved corneal tissue was of blotter-paper appearance and stained readily with fluorescein solution. This area was opaque; a hypopyon filling one third of the anterior chamber was visible through the clearer areas. A distinct groove in the corneal surface, most marked on the nasal side, was present at the margin of the le-

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sion just proximal to the clear corneal area. A hazy outline of a dilated iris could be made out. Only light perception and projection could be elicited, but these were normal. Ocular motility was normal.

Left eye. External and fundic examination of this eye was entirely without pathologic findings.

The patient had had no significant illnesses nor familial diseases pertinent to her present condition. She was married, the mother of three children, and had always enjoyed good health. There had been no visual impairment nor previous ocular complaints, except that one month previously she had removed a minute foreign body from the cornea of the right eye, but without subsequent discomfort.

Diagnosis: 1. Ring abscess of the cornea, O.D.; 2. Hypopyon, O.D.

Therapy. The acuteness and gravity of the ocular picture warranted immediate and intensive therapy. The culture was repeated from the right cul-de-sac, and the organisms were the same as those previously found (B. pyocyaneus, hemolytic Staphylococcus aureus).

Fifteen million organisms of typhoid-vaccine diluted to a volume of 1 c.c. in physiologic saline (0.85 percent) were given intravenously. Although the temperature, pulse, and respiration readings were recorded hourly, no reaction was observed.

Simultaneously, oral sulfadiazine was administered. The initial dose of 2 gm. was followed by 1 gm. every four hours.

Hot boric-acid-solution compresses were instituted for the right eye, for a 10-minute interval every hour. Each hour 5-percent sulfadiazine ointment was instilled and followed by the application of a dry sterile dressing.

The Ophthalmic Service of the Boston City Hospital had had no previous experience with the use of penicillin in ocular conditions, but was granted the use of 50,000 Oxford units. An isotonic saline dilution of 250 units per c.c. had been suggested[1] for topical use. No literature nor information was available as a guide at the time in the intraocular use of penicillin, but, in view of the rapid progression and poor prognosis of ring abscess of the cornea, further delay was not warranted.

At nine o'clock on the evening of January 26th, and with observance of sterile operative technique, the right eye was prepared and local topical anesthesia obtained with 0.5-percent pontocaine. A saline solution containing 250 units per c.c. was prepared from the powdered, sterile, vial-contained penicillin. An empty 1-c.c. syringe fitted with a short, sharp needle was introduced at the limbus at the 3-o'clock position and directed toward 6 o'clock, according to a technique described by Igersheimer.[2] Care was taken to avoid the iris and prevent the needle from striking either the posterior corneal surface or the anterior lens surface. Approximately 0.3 c.c. of turbid aqueous was withdrawn. Leaving the needle in place, the syringe was detached and the contents emptied into a sterile culture tube. Another syringe was then partially filled with penicillin solution, reattached to the needle, and 0.3 c.c. ($\pm$75 units) was injected into the anterior chamber. The needle was withdrawn rapidly, and the conjunctival sac and cornea were flushed with 1 c.c. of penicillin solution. A dry sterile dressing without ointment was applied, and the patient was returned to the ward.

Because penicillin is altered at temperatures higher than 5°,[3] the prepared solution was placed in a refrigerator. It had seemed advisable to warm the syringe containing the penicillin in the palm of the gloved hand before the injection was made, lest the tissues fail to tolerate the chilled solution.

The culture report of the aspirated aqueous proved to be hemolytic Staphylococcus aureus.

Subsequent local therapy consisted of hourly hot boric-acid-solution compresses followed by a direct application of 1 c.c. of penicillin solution, drop by drop, to the cornea.

On January 27th the cornea showed slight improvement in that the density of the central yellowish opaque area had diminished, and thinning out seemed to appear superiorly. The corneal groove persisted. The hypopyon had lessened. A dilated pupil was more easily visualized, and the tension remained soft. Repetition of the intraocular instillation of penicillin seemed advisable and was performed. The procedure was identical, but culture of the aspirated fluid resulted in no growth!

On the following day a definite improvement was noted, with the absence of an hypopyon and a thinning of the central opacity, which had taken on a less necrotic appearance. Dr. Josef Igersheimer saw the patient in consultation and agreed with a diagnosis of ring abscess.

On January 31st progressive improvement of the corneal lesion was observed to have continued. The peripheral clear cornea persisted, and the density of the opacity lessened, receding toward the center. No synechiae were observed, but the pupil was kept dilated by instillation of one drop of 1-percent atropine sulfate solution on alternate days. The tension remained soft. The ciliary congestion persisted.

The oral administration of sulfadiazine was reduced to 4 gm. daily. Penicillin solution was then omitted between the hours of 12:00 midnight and 7:00 in the morning, 5-percent sulfathiazole ointment being used for the last dressing of the day.

Culture from the cul-de-sac showed no growth.

On February 2d, lessened ciliary congestion and ocular tenderness were observed. The ulceration stained with fluorescein was one-half its original size and was located slightly eccentrically to the nasal side. A crescent-shaped, nonstaining furrow remained at the 3-o'clock position within the opaque but not ulcerated area.

Local therapy was reduced to three-hour intervals during the day.

Five days later only a 2-mm.-diameter area took the stain. No synechiae were visible. The entire area of involvement appeared as a dense opaque area with the same clear periphery. Vision had improved to the perception of fingers at four feet.

The allotted penicillin was exhausted, but local sulfathiazole ointment was substituted. Oral sulfadiazine was continued. The blood sulfadiazine level on February 4th was: free = 2.3 mg. percent; total = 2.6 mg. percent. The blood Wassermann report was negative.

On February 10th, the lesion was completely healed with a resultant dense central corneal scar. The patient was discharged to the Out-Patient Department and advised to use White's ointment and to continue the application of warm compresses.

The patient was seen in the Out-Patient Department on February 14th, 21st, and on March 6th, and showed subsiding congestion and constant visual improvement. On March 6th, her vision O.D. was 10/200, and the eye was white and quiet. The pupil was active and without synechiae. Tension remained normal to palpation. By slitlamp, the corneal opacity was observed to involve the entire thickness of the substantia propria; it was covered by smooth epithelium. Peculiarly enough, the demarcation of the scar was equal to the extent of the corneal involvement at the height of the disease. It had a disciform appearance surrounded by clear

cornea; the density of the opacity varied in different areas. The nasal furrow persisted as part of the border of the scar. Several fine deposits remained upon the anterior capsule of the lens.

An ointment containing 2-percent yellow oxide of mercury was prescribed to be applied four times daily to stimulate resorption of the scar.

Comment

A case of ring abscess of the cornea has been presented wherein dramatic therapeutic results were obtained with the local extraocular and intraocular use of penicillin plus oral sulfadiazine. The cases of recovery of ring abscess which have been reported are few. No such case has come to the author's attention in which penicillin was employed as an intraocular instillation.

The use of a saturated solution of sulfanilamide (0.8 percent) as an injection into the anterior chamber has been reported in a case of purulent iridocyclitis.[2] This solution was tolerated well by the tissues but one could not predict the effect on the tissues of a solution of penicillin. "Penicillin"* supplied as the sodium salt of penicillin was dissolved in normal saline, from which a yellow-tinged solution (250 units per c.c.) was obtained. Approximately 0.3 c.c. (±75 units) was instilled. Local hourly irrigation was performed with the same solution. It was necessary to repeat the intraocular instillation 24 hours later. The astonishing subsidence of the process, disappearance of the hypopyon, and negative culture evidenced the therapeutic effect. The solution was well tolerated by the tissues; no synechiae have remained and the lens is clear. Only a deep scar of the cornea remains involving the tissue to the extent of the original lesion.

The organisms obtained were hemolytic Staphylococcus aureus from the anterior chamber and cul-de-sac, B. pyocyaneus from the cul-de-sac.

The effect of the sulfadiazine as against that of penicillin in this case cannot be debated. The aim was a therapeutic result and the gravity of the situation demanded that all agents at hand be used. One can conclude, however, that penicillin was well tolerated by the tissues in the concentration employed for intraocular instillation.

Iontophoresis has supplanted the need for intraocular injections in many instances. The fact that the apparatus, simple as it may be, is not possessed by all institutions, may necessitate anterior-chamber instillation of penicillin.

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* The penicillin used was Lot No. 95156, E. R. Squibb and Sons, and was obtained at the Boston City Hospital through the Committee on Medical Research of the Office of Scientific Research and Development under the supervision of the Committee on Chemotherapeutic and Other Agents, Division of Medical Sciences, National Research Council.

References

[1] Keefer, C. S. Penicillin in the treatment of infections. Jour. Amer. Med. Assoc., 1943, v. 122, no. 18, p. 1217.
[2] Igersheimer, Josef. Intraocular injection of sulfanilamide in a case of purulent iridocyclitis. Amer. Jour. Ophth., 1943, v. 26, no. 10, p. 1045.
[3] Herrell, W. E. The clinical use of penicillin. Jour. Amer. Med. Assoc., 1944, v. 124, no. 10, p. 622.

MYXOMA OF THE LOWER EYELID

ARNO E. TOWN, LT. COMDR. (MC), U.S.N.R.
Bethesda 14, Maryland

Mixed tumors of the eyelid with the typical structure of the lacrimal gland are common, about 256 having been reported, but, in so far as it was possible to ascertain, no previous reports of a myxoma of the lower lid composed of the structure of a sweat gland have been made.

In the thirteenth annual report of the Memorial Ophthalmic Laboratory, Giza, Cairo, there is published a case of a mixed tumor of a sweat gland of the eyelid. It occurred just above the inner canthus of the left upper eyelid, and was about 2 cm. in diameter. It was encapsulated and was easily shelled out. Microscopically it had the typical appearance of a mixed-cell tumor of the salivary-gland type. The component cells were rounded, cubical, spindle shaped, and angular, arranged in islands and branching strands. Some groups of cells had a glandular arrangement. The stroma was loose and cellular and in many places there was evidence of mucin formation, giving rise to the appearances of mucoid or myxomatous connective tissue.

Mixed tumors may also develop in regions removed from lacrimal glands, salivary glands, and the like. They occur in the pharynx, on the lips, and other sites.

As to their origin, there are many opinions, which may be grouped into two theories: the one proposing a conjunctival origin, the other proposing an endothelial origin. Other authors attribute to these tumors a mixed ciliary epithelial origin.

Regarding pathogenesis, the majority of writers are in agreement in considering these tumors to be derived from disturbances in development. Some believe that the tissue of the tumors is the result of a proliferation of the already developed glandular tissue; the glandular lobules change into new lobules whose septa of connective tissue are developed from previously existing septa. This accounts for the lobular structure of the tumor.

CASE REPORT

A woman, aged 39 years, had noticed a small growth near the inner angle on the left lower lid for two months prior to consultation. Examination revealed a small mass surrounding the left lower punctum, elevated, and with a glassy cystic appearance. The punctum and canaliculus were patent. The tumor was not encapsulated and at the time it was dissected from the lid, it was difficult to determine the line of demarcation from the orbicularis muscle. The wound was closed with black-silk sutures and healing was uneventful.

PATHOLOGI REPORT by Algernon B. Reese, M.D.: *Subject,* Myxoma of the eyelid; specimen from margin of the left lower lid. *Stains:* hematoxylin and eosin, trichrome, mucicarmine.

The specimen consists of two fragments of tissue both of which are covered on one side by a layer of stratified epithelium showing slight tendency toward keratinization along the surface. The nuclei of the basal layer are more darkly staining and cylindrical. The one piece consists almost entirely of tumor tissue extending from the corium into the deeper tissue, where it infiltrates between striated muscle fibers. The cells of this tumor are stellate and contain a nucleolus which varies a great deal in size and shape, stains lightly with hematoxylin, and has a diffuse almost homogeneous distribution of the chromatin. There is a scanty amount of faintly eosin-staining proto-

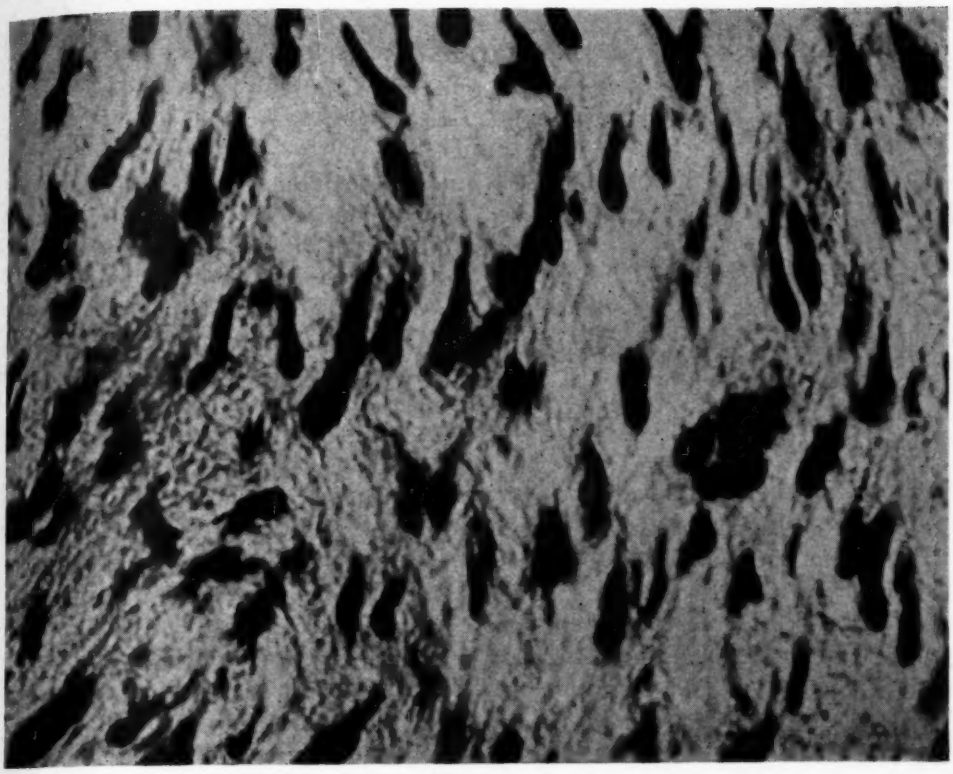

Fig. 1 (Town). Myxoma of the lower-lid margin (×350).

plasm and a coarse, wavy fibroglia structure. The main characteristic of the tumor, though, is the intracellular substance, which stains faintly blue with hematoxylin, faintly pink with mucicarmine, and faintly red with trichrome. In places it is almost homogeneous but at most sites it contains a fine fibrillar structure. This intracellular substance seems to compress the nuclei and fibroglia. Immediately beneath the epithelium, the nuclear elements are much greater and the intracellular substance less, so that here the tissue more closely resembles the usual connective tissue. There is no tendency to encapsulation, but the tumor borders have rather poor demarcation due to its gradual infiltration into the surrounding structures.

The second piece of tissue is composed almost entirely of a normal-appearing connective tissue in which is striated muscle, a hair follicle, and some rudimentary glands that seem to resemble the sweat-gland type. Beneath the epithelium at one site is some tumor tissue which resembles that described in the first specimen.

Diagnosis: Tumor of lid—myxoma, probably derived from the intermuscular connective tissue.

Drs. A. Purdy Stout, Fred Stewart, and Hillman have examined this specimen and concur in the diagnosis.

U. S. Naval Hospital.

SOCIETY PROCEEDINGS

EDITED BY DR. DONALD J. LYLE

ROYAL SOCIETY OF MEDICINE

SECTION OF OPHTHALMOLOGY

October 8, 1943

MR. FRANK A. JULER, *president*

Abstracted by permission from the Proceedings of the Royal Society of Medicine (Section of Ophthalmology), volume 37, page 29.

BURNS OF THE EYELIDS AND CONJUNCTIVA

SURGEON REAR ADMIRAL CECIL WAKELEY, in opening the discussion, said that the problem of burns of the face and eyelids has been a very important one during this war as well as the last war. In the last war, in the navy, there were over 6,000 cases of burns, 95 percent of which affected the face and hands. In the services, whether in the airplane, the tank, or the large or small ship, the face and hands suffer most severely. The first-aid dressing in those days was picric acid, but the cases showed that this was of no use whatever, because when put on and left there, it coagulated the skin to such an extent that a second-degree burn was converted into a third-degree burn when the dressings were removed.

In 1916 it was realized that there were two fundamental things in the treatment of burns: (1) elimination of sepsis; and (2) skin grafting for the third-degree or deep burn.

Soon after the beginning of this war there was an undue number of facial burns which were the result of the men having the face completely unprotected. At the end of 1939 extra protection was devised for men who did not wear a gas mask. It consisted of cellulose acetate goggles and aertex heat-resisting material for the nose and mouth. This protective device markedly decreased the incidence of burns of the face. The greatest proportion of cases are produced by exploding bombs. The bomb may not have touched the patient at all, but the effect of the blast is to split the skin, and produce a superficial burn of the hair and face. There are usually other lesions as well. Patients have been successfully treated with triple-dye jelly.

In a bomb flash burn the blast may also cause the skin to split. Some of these lesions of the skin penetrate a quarter of an inch, but the face is so vascular that practically no scarring is experienced from the effect of such burns, and there is no permanent disability.

In the treatment of burns, there is a vast difference between the case which is brought to the hospital within an hour of the accident and the case which does not reach the hospital for five or six days. In the Royal Navy at the present time 50 percent of the casualties due to burns occur on smaller ships which have no medical officers on board and often cannot reach port for five or six days. In 1939-1940 one half of these patients died. By the time the men reached the hospital they were moribund. The use of tannic acid was abandoned and a coagulant such as the triple dye or gentian violet was used and the mortality rate was reduced to 5 percent.

At the beginning of the war it was thought that every case of burns should have intravenous plasma, or saline. At the present time only 1 out of 10 is given intravenous therapy and that is due to the fact that this method has been replaced by the intake of fluids by mouth.

Shock. He said that in the opinion of the Navy morphia will never kill a man who is in pain. As to the application of heat in shock it has been stated that the clinician is apt to overheat his patients who are suffering from shock. This may be true in some cases, but he said he has never seen a patient who was badly shocked suffer from too much heat. As soon as the patient's clinical condition has returned to normal the heat should be reduced.

Wing Commander J. C. Neely said that an analysis of 120 cases of burns received at an R.A.F. hospital showed that in 80 percent the face was affected, and, of this number, 20 percent had ectropion and 5 percent had the globe affected. The causes of these types of burns were: (1) petrol flames, incendiary and flash bombs; and (2) caustic acid, alkalis, and gaseous chemicals. The goggles which were first issued were inadequate because of their restricted visual fields. These have been modified according to the specifications of Air Commodore Livingston and now offer a very wide field of vision.

Flight Lieutenant D. C. Bodenham said that, as had been pointed out, in war burns of the face due to exposure to flame the eyelids were very frequently involved. He stressed the importance of the sebaceous glands and hair follicles of the skin, because in destructive burns there were invariably isolated epithelial cells left in the dermis and it was from these island cells, by spreading and coalescing, that healing occurred.

The two types of burns, important from the point of view of treatment, were the superficial second-degree burn affecting the epithelium only, and the destructive or third-degree burn in which all or practically all of the dermis was destroyed. But it was surprising how often epithelial glands survived and were sufficient to bring about the healing of small areas, although in the case of extensive destruction this was much too slow, and skin grafting was necessary.

He showed a case of a typical second-degree burn, saying it would heal with very little trouble, almost without treatment, and would present practically no problem provided it was kept clean.

The real problem was the destructive third-degree burn, with the epithelium hanging in loose shreds, exposing the underlying dermis, which was coagulated. No treatment would entirely prevent scarring in these cases.

In facial burns, because of the very loose supporting tissues, a tremendous amount of edema developed even with a moderate burn. The edema appeared a few minutes after the accident and increased up to 12 hours. It remained at the maximum from 12 to 36 hours and then began to subside.

In the Air Force there were only a few flash burns. These burns were due to the instantaneous combustion of magnesium used in flash bombs. In these the exposure was a matter of a fraction of a second, whereas in the flame burn it was anything from 10 to 60 seconds, and permitted a chance to close the eyelids, which tended to save the globe at the expense of the lid. In the flash burn, although there was conjunctival involvement, the exposure was so brief that the burn was largely superficial. The globe in these cases was somewhat protected by the constant film of moisture which bathed the cornea and the conjunctiva.

In magnesium flash burns tattooing of the globe sometimes occurred, owing to minute particles being driven into the globe by the force of the explosion. Unfortunately they were often too small and too numerous to be removed surgically. Though the skin of the eyelid was particularly delicate, it was surprising how,

even in the worst burns of the eyelids, the tarsal plates remained intact.

Treatment. In the Royal Air Force the results with tannic acid were so unsuccessful that quite early in the war its use was forbidden. The present-day treatment rested on simple principles; namely, to prevent infection and to do as little harm as possible to the healing tissues. If infection developed it should be treated specifically. Early healing should be the aim and, if necessary, it should be assisted by skin grafting. For some 18 months, he said, they had been using the synthetic detergent, cetyl trimethyl ammonium bromide. It was used in 0.75-percent water solution and was a very good antiseptic. It combined many valuable features for the primary cleansing of fresh burns. It was applied with a swab of cotton-wool. Any loose-hanging threads of epithelium were removed. Cleansing was followed by an application of sulphonamide, either powder or 3-percent cream. The face was covered by coarse mesh vaseline gauze, and this made a very soft, gentle, nontraumatic dressing, and one which could be easily removed.

Facial burns were particularly open to infection. The nose and mouth could not be completely covered and formed an adjacent source of staphylococci and streptococci, which obtained easy access to the burned tissue; in this way infection, particularly staphylococcus, occurred almost always in the treatment of these severe burns. Penicillin had been used as a local application. If it was used in a cream base he said he preferred a simple mixture of lanette wax and vaseline. Penicillin, made to a strength of 100 units per gram, was consistently effective in eliminating streptococci and staphylococci from granulating surfaces. It was applied every 24 hours, and the cases as a rule responded within four days. In undertaking specific treatment, he said they often reverted to penicillin because of the failure of the sulphonamides. In this way they obtained the conditions under which healing took place most rapidly.

Later when contracture of the lids developed, keratitis was not infrequent, and might result in ulceration with loss of the eye, though this had not occurred in his experience. In the milder cases simple measures might be employed, such as constantly keeping the globe moist with saline and using a lubricant like liquid paraffin. In the severe cases with complete ectropion which developed before the face and lids had healed, this alone would not prevent keratitis. A patient was shown wearing a contact lens.

Effective protection to the cornea could be given much more simply by wearing a standard anti-gas shield. These eye shields were particularly valuable in protecting the cornea when such cases came to operation for skin grafting of other areas.

They could be used with complete confidence and many sore eyes could be avoided by this simple measure.

Squadron Leader G. W. Cashell said that it was interesting to note that in the R.A.F. type of burns of the face it is unusual to find any burning of the cornea or conjunctiva. The lids, which were instinctively closed, bore the brunt of the trauma, and in the majority of cases there was only some slight reddening of the conjunctiva, and slight edema of the corneal epithelium.

Cases of direct burning of the conjunctiva have been due to: (1) a magnesium flash bomb; (2) incendiary bomb; (3) the effect of phosphorus; and (4) concentrated sulphuric acid.

In treating cases where the conjunctiva and cornea were directly involved, the important thing was the prevention of adhesions between these two structures, or between the palpebral and ocular con-

junctiva with obliteration of the fornix. It was much easier to prevent these complications than to deal with them.

He reported details of five cases. The points to be noted with regard to these special types of burns were: (1) control of infection; (2) prevention of symblepharon, which could be guaranteed by the use of a rapidly made plastic contact lens; and (3) mucous membrane could be used to restore the conjunctival fornix, where obliteration had occurred, and was less irritating than skin.

Mr. T. Pomfret Kilner confined his contribution to the showing of a film which indicated clearly the technique of eyelid grafting. This seemed all the more justifiable since a very high percentage of the repair work on burns about the eyelids is concerned with the treatment of ectropion.

He advised that when possible only one eyelid should be operated on at a time; that it was unwise to graft upper and lower eyelids at the same operation, for if this were attempted, it would be difficult to obtain over-correction, on which success so much depended. He said that approximation of eyelids by tarsorrhaphy and grafting both eyelids with a single mold-applied graft failed to give the necessary area of new skin, reëversion of the eyelid over the mold being essential.

He also stressed: (1) the importance of early grafting—even at the risk of recontracture or partial failure—to provide covering for an exposed cornea and avoidance of ulceration and opacity formation; (2) the need to remember the bearing of other scarred areas of the face on the eyelids—release of scarring of the cheek or forehead regions often being needed to overcome drag on the eyelids; and (3) the importance of diagnosing the extent and type of loss.

Mr. Frederick Ridley spoke on the protection of the eye. His observations were based upon the experience of a Maxillo-Facial Unit, where more than 100 cases of burns so severe as to require lid grafting had been treated. In summarizing, he stated that no coagulants should be used in the treatment of the eyelids; the splinting effect, the difficulty of proper care of the eye, the discomfort, and the fact that nothing is gained by waterproofing such a minute area are strong contraindications. Tulle gras dressings and saline packs are satisfactory. The full saline bath has a dramatic effect in alleviating blepharospasm and photophobia. Grafting of the lids should be undertaken as soon as lid retraction develops. The exposed cornea may be protected by contact lenses; delay in production, discontinuity of wearing, retention of pus, and discomfort are serious disadvantages. Lid suture is impracticable in the acute septic stage and useless in the cicatricial stage. Early cases with loss of lid tissue may be saved by sliding down a frontal skin flap and suturing over the exposed eye.

Two cases of whole-thickness skin grafts to the lower lid

Major A. Seymour Philps (for Sir Harold Gillies) presented two patients who had had whole-thickness skin grafts taken from behind the ear. Attention was drawn to the good color match of this skin with the surrounding area.

The first patient was badly burned about the face and hands, which resulted in marked scarring and ectropion of the lower lids of both eyes. He had both lower lids grafted in May, 1943, and a skin-grafting operation on his nose in August, 1943.

The second patient, although not injured by burning, had a marked degree of cicatricial ectropion of the right lower lid. This was grafted in August, 1943, and after two months the result appeared to be very satisfactory.

METALLIC FOREIGN BODY IN THE VITREOUS

VIOLET M. ATTENBOROUGH (for Mr. T. C. Summers) presented the case of a 37-year-old riveter who was first seen in March, 1943. He gave a history of having received an injury to the right eye one year ago while riveting duralumin. Vision in the right eye was 6/9, in the left eye 6/6. A large foreign body could be seen projecting into the vitreous. This proved to be nonmagnetic. The eye was quiet. In September the patient complained that vision in his right eye was failing; it was reduced to 6/24. The vitreous was hazy and there were metallic deposits on the surface of and in the lens capsule. There was a greenish discoloration throughout the entire lens. The left eye was unaffected.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 1, 1943

DR. SIGMUND AGATSTON, *chairman*

TOPICAL DIAGNOSIS OF HOMONYMOUS HEMIANOPIA

DR. ALFRED KESTENBAUM subdivides, for diagnostic purposes, the optic pathway behind the chiasm into six sections: (I) optic tract; (II) external geniculate body; (III) anterior third of the optic radiation near the internal capsule; (IV) and (V) middle and posterior thirds of the radiation in the white substance of the temporal, parietal, and later occipital lobes; and (VI) visual cortex.

The following signs are looked for:

1. Wernicke's hemianopic pupil reaction indicates a lesion in section I but it appears very rarely.

2. Atrophy of the discs, more severe on the side of the hemianopia, develops in lesions of sections I and II, but not before several months and is, therefore, not available in recent cases.

3. Optokinetic-nystagmus test. Rotation of a striped drum normally causes nystagmus. In certain cases of homonymous hemianopia this nystagmus is absent or weaker on the side of the hemianopia. This sign is significant only if there is a definite, large difference in the nystagmus of the two sides. In 41 cases in which the site of the lesion was verified (autopsy, biopsy, and so forth) the sign was positive 22 times. The radiation was always involved, twice in the temporal lobe, 16 times in the parietal lobe, and 4 times in the temporo-occipital region; that is, always section IV or V. The sign was negative 19 times and in all but one the optic radiation was not involved. Disturbance of optokinetic nystagmus on the side of the hemianopia indicates, therefore, section IV or V.

4. In certain cases of homonymous hemianopia, the eyes follow a moving object with a normal smooth movement to all sides except the one *opposite* to the hemianopia. Here the movement is made up of a series of jerks or cogwheel movements. Among 33 cases this sign was found 9 times, in all of which the parietal lobe was involved. The sign, therefore, indicates section IV.

5. In homonymous hemianopia the visual fields are sometimes very incongruent apart from the temporal crescent. Only definite incongruence can be regarded as significant. In 31 cases it was found 10 times. The lesion involved the optic tract and central ganglia 4 times, and the visual cortex 5 times. Incongruity, therefore, indicates a focus in sections I, II, or VI, the optic radiations not being involved.

6. Macular sparing of less than 3 degrees was found occasionally in any location. Macular sparing of more than 3 degrees was present in 6 of 26 cases. In

all the focus was in the occipital lobe or cortex, that is, section V or VI.

The presence or absence of these six signs allows localization of the seat of the lesion by purely ophthalmologic tests.

Discussion. Inquiry as to the significance of the Behr pupil was made. It was pointed out that a brain tumor is a complicated structure, not naturally circular and with swelling and disturbed circulation about it, all of which may make clinical diagnosis unreliable and calling for encephalography and ventriculography.

Dr. Kestenbaum stated that Behr's sign, a wider pupil on the side of the homonymous hemianopia, is infrequent. The schematic system he presented is an indication of the localization, the final diagnosis is up to the neurologist.

Unusual neuro-ophthalmologic case presentations

Dr. Philip S. Goodhart presented and fully explained a motion-picture film, demonstrating unusual ophthalmologic conditions with pathologic changes in the central nervous system.

A *Marcus-Gunn phenomenon* was demonstrated in a girl, aged 13 years. She showed abnormal associated movements of the right upper lid synchronous with movements of the lower jaw.

Skew deviation. A nine-year-old boy was shown; he was later operated on and a large cerebellar neoplasm was removed. The patient was shown previous to operation and the skew deviation demonstrated; upon outer gaze the homolateral eye turned downward and outward, the other eye upward and inward. Skew deviation was due to brain-stem lesion.

Types of nystagmus. Three patients with multiple sclerosis demonstrating different types of nystagmus were shown. The pathology was doubtless in nerve fibers or centers of association between the longitudinal fasciculus and respective centers controlling eye movements.

Weber's syndrome. A man, aged 50 years, was presented. He had paralysis of the third cranial nerve with contralateral hemiplegia; vascular lesion of the basis pedunculi.

Duane syndrome. Two patients were shown in which unilateral and bilateral Duane syndrome, respectively, were demonstrated. Both were neurologic cases and the finding of the Duane syndrome was incidental, the latter due to fibrosis of the levator oculi superioris and of the external rectus. As a result there is widening of the palpebral fissure as the eye turns outward and narrowing as it turns inward; there is also limitation of external gaze in the affected eye.

Postencephalitis syndrome. There is inability to open voluntarily the closed eyes without throwing the head far backward.

Congenital absence of posterior orbital wall with resulting pulsating exophthalmos in a case of von Recklinghausen's neurofibromatosis was demonstrated.

Pathologic specimens were also presented.

Ocular findings in 1,200 cases of head injury

Dr. Nathan Savitsky personally studied 1,200 cases over a period of 13 years. All the injured were studied three weeks or later after the initial trauma. No acute cases were included in this series.

He encountered 112 organic ocular findings attributable to the head trauma in 109 different patients. The commonest finding was discomfort with conjugate gaze which was seen in 56 patients (4.6 percent). Control studies of the incidence of discomfort with conjugate gaze have been completed with Dr. M. Madonick. Such discomfort was found in only 1 of 2,000 cases diagnosed as psychoneuroses

and in 4 of 10,000 draftees. The other organic ocular findings were:

1. Unilateral optic atrophy—2 cases.
2. Divergence paralysis—5 cases.
3. Isolated ocular palsies—9 cases; of these 5 involved the superior rectus and 3 had ptosis.
4. Bilateral sixth-nerve palsy—2 cases.
5. Pupillary changes were noted in 11 cases as follows: unilateral dilation—7; bilateral dilation—2; paradoxical pupil—1; and irregular fixed pupils—1.
6. Enophthalmos—2 cases.
7. Limitation of upward gaze—1 case.
8. Visual-field disturbance—8 cases; of these 6 were homonymous hemianopia, 1 was a ring scotoma, and 1 central scotoma.
9. Bilateral papilledema—2 cases.
10. Nystagmus—3 cases; 2 rotary and 1 lateral.
11. Alexia—1 case.

Attention was called especially to the frequency of divergence paralysis due to an injury to an hypothetical divergence center in the brain stem. Nystagmus is a rare sequel to head injury, and its presence should make one particularly careful about ruling out concomitant disease. In 12 of the isolated ocular palsies there was no evidence of injury to the orbit or eye. Indirect traumatic palsies of the ocular muscles can take place. In neither case of optic atrophy was there direct injury to the eye or orbit.

In 15 cases in this series the ocular findings were due to diseases unrelated to the trauma. Careful neurologic examination and accurate anamneses are extremely important. In 6 of these cases there was optic atrophy unrelated to the trauma. In 218 cases (16 percent) there was undoubted evidence of functional superimposition in the nature of conversion hysteria. Of these 186 had a function hemisensory syndrome with blurred vision or diminished perception of brightness on the same side. Contraction of the visual field on that side was inconstant. In addition there were 2 cases with markedly contracted fields, 3 with monocular diplopia, and 1 case of spasm of convergence.

The most common subjective complaints were transitory obscuration of vision with change of position, blurring of the printed page after reading for a short period of time, and spots before the eyes. Sensations of heaviness, tightness, and burning in the eyes were frequently reported in these cases, especially in those who showed other evidence of psychogenic superimposition.

Discussion. Dr. A. Kestenbaum agreed with Dr. Savitsky regarding hysteria and cited a case of encephalitis simulating hysteria; the patient had retinospasm every Monday, Wednesday, and Friday.

Dr. M. Davidson said he has frequently found miosis on the side of scalp laceration in cases of head injury. Optic atrophy, appearing after head injury, when it had not been noted on examination in the hospital for the head injury, must be assumed not to have been present before. He was not convinced that divergence paralysis, seen a few times, was organic in nature. Early presbyopia is of frequent occurrence, and glasses are immediately recommended. Opticochiasmatic arachnoiditis, often not properly diagnosed preoperatively, is being discovered at operation following head injury.

Dr. Savitsky, in conclusion, pointed out that his series included the most severe as well as mild cases of head injury and that the severity made no difference in the optic sequelae as far as he could see. He has seen cases of optic neuritis—that is, inflammation of the nerve head—following concussion. There is such a thing as traumatic hydroencephalitis with papilledema. He has not found anisocoria with scalp lacerations following

head injuries although he has looked for it.

Leon H. Ehrlich,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

November 15, 1943

DR. VERNON M. LEECH, *president*

(Presented by the Department of Ophthalmology, University of Chicago)

CHRONIC NONINFLAMMATORY GLAUCOMA

DR. THOMAS D. ALLEN. C. O. P., a man, aged 62 years, was first seen 16 years ago with Dr. Wilder. At that time the vision was R.E. 20/40, corrected to 20/30+; L.E. 20/30+, corrected to 20/20+. The pupil of the right eye measured 4 mm. and the left 3 mm. No medication had been used for several days. The tension was R.E. 60 mm. Hg, L.E. 27 mm. Hg (Schiötz). The optic disc of the right eye was sharply outlined and glaucomatous cupping, 4 diopters deep, extended to the periphery. The vessels bent sharply at the disc margin and there was a glaucomatous halo. The optic disc of the left eye had a large physiologic cup which sloped temporally and extended nearly to the disc edge. The visual field of the right eye was considerably contracted and indented almost like a swastika; that of the left eye was fairly good.

The patient was advised to use 1-percent pilocarpine six times a day and to adopt general hygienic measures. He was seen at intervals, and finally a trephining operation was performed on the right eye on January 30, 1928. No surgical difficulties were encountered, but atropine was instilled in both eyes on the first postoperative day. This caused the tension to rise to 60 mm. in the left eye, but it was reduced to 20 mm. by immediate and vigorous measures. Postoperative vision with correction was R.E. 20/20−; L.E. 20/15. The tension, R.E., varied between 10 and 22 mm., an average of about 15 mm. The central vision gradually decreased and the visual fields contracted. Then, in 1941, a secondary infection robbed the patient of all vision in this eye. This infection was conjunctivitis, corneal ulcer, and endophthalmitis which was not controlled by four weeks' treatment with small doses of sulfanilamide. Cure was effected, however, in two or three days, when the dosage of sulfanilamide was greatly increased. Hemolytic Staphylococcus albus was cultured from the ulcer. The tension, R.E., which was high at the time of the infection, subsided to normal. Since that time there have been no further complications.

The tension of the left eye remained low on miotics for over two years. In July, 1930, the use of pilocarpine had been stopped for 24 hours, the tension was found to be 66 mm., although the vision and fields were good. An iridencleisis was performed under a thick conjunctival flap, the pupillary edge being cut and the iris tucked in the corner of an oblique conjunctival-limbus incision. The patient recovered very quickly from the operation. The tension since that time has never risen above 20 mm. and has usually been 10 or 12 mm. Vision with correction, more than 13 years after operation, is 20/20+. The visual field has remained normal.

This case was shown as an illustration of iris-inclusion operations. There remained at this time a very circumscribed, somewhat glassy bleb over the trephined area of the right eye and slight conjunctival edema in the left eye. The trephining

was done comparatively later in the course of the disease than was the iridencleisis. It might be unfair to conclude that the iris-inclusion operation is better than the trephining from this one case; one might get the impression, however, that the inclusion operation is less hazardous than the trephining.

Melanosis

Dr. Thomas D. Allen presented L. B. C., a woman, aged 64 years, who was first seen with Dr. Wilder nearly 24 years ago. At that time she had a rather darkly pigmented superficial lesion at the nasal side of the right eyeball, about 12 by 12 mm., extending about 2 mm. onto the cornea. This had grown from a small spot first noticed when she was four years old. During the year 1919 it began to show some activity. After several consultations she was given 45 radium treatments of 50 to 100 mg. each, because she refused to have the eye removed. At the end of 15 months the growth seemed to have almost entirely disappeared. Several months later it began to spread again in the upper and lower fornices. After a course of 40 more radium treatments it became apparent that the growth was progressing.

Dr. William Brown then gave nine treatments with heavy doses of radium, a total of 110 mg. As a result the lesion completely disappeared in about 6 months and had not reappeared after 21 years. The patient had no cataract, although there was a very slight peripheral cortical change in each lens. Vision in each eye was 20/20+ with correction. The patient was in excellent health.

This case, which was reported by Dr. Wilder in 1923, before the American Ophthalmological Society, was shown to call attention to the following facts: (1) The lens had not suffered; (2) the patient remained well and had normal vision; and (3) there was no recurrence of the tumor.

Bilateral nerve atrophy and nystagmus

Dr. R. J. Madi. A. C., a girl, aged 16 years, was first seen in the eye clinic at Central Free Dispensary in June, 1938. The parents stated that oscillating movements of each eye were first noted when she was six years old and that her vision seemed poor.

On examination the vision, R.E., was 0.2−1; L.E., 0.1. A horizontal jerky nystagmus of varying amplitude was present, increasing in lateral gaze to the right or left. The palpebral conjunctiva of each eye was mildly injected. The extraocular muscles, tactile tension, lids, cornea, and anterior chamber were normal in each eye. The irides were light blue. The media were clear. The disc of the left eye was a marked typus inversus with a narrow inferior conus; that of the right eye was a moderate typus inversus. Each disc showed a grayish pallor.

She had been refracted each year and the best vision obtainable with correction was 0.4−1 in each eye. She progressed satisfactorily in sight-saving classes.

Bilateral posttraumatic optic-nerve atrophy

Dr. Charles A. Learsy. The patient, a 35-year-old man, was first seen at Central Free Dispensary of Presbyterian Hospital on October 18, 1943. He had had a head injury on February 10, 1943, and was unconscious for about two weeks. The right eye was blind on discharge from the hospital. Since June, 1943, some vision gradually returned. At first examination vision, R.E., was 4/200; L.E., 0.8−2. Each disc, particularly that of the right eye, was pale with fairly definite borders but there was some connective tissue in the central ex-

cavation and white connective-tissue sheathing on the central vessels. The peripheral field of the right eye was reduced to a wedge-shaped area in the inferonasal quadrant; that of the left eye showed only slight temporal constriction.

X-ray examination on October 14, 1943, showed an "old fracture through the roof of the right orbit, with slight separation of fragments." The optic atrophy was considered probably secondary to an initial papilledema which followed increased intracranial pressure and some additional direct involvement of the right optic nerve.

Fibroplasia of retina

Dr. R. C. Gamble. J. D., a six-year-old girl, was first seen at Children's Memorial Hospital five years ago. She was born prematurely, her birth weight being 25 ounces. The right eye was small, the anterior chamber shallow, and the pupil small. The lens was clear but behind it was a gray mass. No red reflex was obtained. The left eye was similar to the right except that the membrane behind the lens was on the nasal side only. A red reflex could be seen on the temporal side and in this area an arborizing group of blood vessels could be seen. A cataract then formed in this eye so that the membrane and vessels could not be seen.

This bilateral type of retinal fibroplasia is found in premature children. There is a unilateral type of persistent posterior fibrovascular sheath which is found in children born at term.

Bilateral retinoblastoma

Dr. Arthur J. Strich. The patient, a 2½-year-old girl was admitted to Children's Memorial Hospital because of what appeared to be a severe inflammatory condition of the right eye, blepharospasm, lacrimation, and pain. The cornea was yellow and opaque. The tension appeared to be normal. The fundus of the left eye, well seen through the clear media, was dominated by large gray choroidal patches traversed by undisturbed retinal blood vessels. A diagnosis of endophthalmitis in the right eye and exudative choroiditis in the left eye appeared rational except for the clearness of the media of the left eye. As the lesions of the choroid of the left eye gained thickness and the discomfort caused by the right eye did not subside, the latter was enucleated. A retinoblastoma with an unusual amount of calcification was found. To this Dr. Gamble attributed the inflammatory character of the pathologic condition, as the areas of calcification were imbedded in large leukocytic infiltrates. The child received radiation therapy.

Two cases of endophthalmia

Dr. Arthur J. Strich. Each of two babies had had an endophthalmitis in recent months, and each received energetic atropinization and sulfa therapy.

The first case followed a pustular dermatitis. Culture from the skin lesions revealed Staphylococcus aureus and albus. Treatment was started the sixth day after the eye became red. The outcome was retinal detachment and atrophia bulbi.

In the second case the endophthalmitis developed in the course of a meningococcic meningitis; treatment was started on the third day after the eye became red. A slight discoloration of the iris and a few spots on the anterior surface of the lens were the only remaining findings.

Tapeto-retinal degeneration

Dr. Arthur J. Strich. The patient, a two-year-old boy, was brought to the Children's Memorial Hospital four months ago because of poor vision and nystagmus. He was typical of a small group of children with these symptoms,

who were under observation. The ophthalmoscopic findings showed a pigmentary change, a large central area of very fine depigmentation and dustlike pigmentation. The discs were pale, and the blood vessels very thin. The macular regions and the periphery did not show anything of significance. There seemed to be some mental retardation. The only significant finding in the family history so far was that the mother had what was termed a "menopausal psychosis."

This was not the ordinary form of retinitis pigmentosa, in which the changes are in the periphery and not in the central region. It was not so-called central pigmentary degeneration because there the pigment, according to Duke-Elder, appears as "either spiderlike clumps or scattered black dots forming an island around the macula," whereas in these cases the pigment appeared as an extremely fine dust. It was not the infantile form of amaurotic familial idiocy in which, according to Spielmeyer and Vogt, the pigmentation appears as a well-defined patch in the macula. It may be that this form represents a distinct form of what Leber termed "tapeto-retinal degeneration."

Disseminated chorioretinitis, right eye

Dr. Justin M. Donegan. A woman, aged 38 years, was first seen in the Central Free Dispensary on November 4, 1943. Three months previously vision in the right eye failed overnight to the degree that she could not distinguish faces at 10 feet. There was no associated pain nor were there inflammatory symptoms. The vision of the left eye had always been poor. The patient was under treatment in another clinic for congenital syphilis.

Examination showed that the corrected vision was R.E. 0.4+1; L.E. 6/200. The ocular media were clear; the disc in the right eye was normal; that of the left eye was a typus inversus. Just temporal to the fovea of the right eye was a slightly raised greenish-black pigmented mound, 1 P.D. in size, and near its nasal edge was a small bright dot of hemorrhage. The macular region of the left eye showed a black-and-white roughly horizontal oval area of old healed chorioretinitis measuring 2.5 by 1.5 P.D. Immediately adjacent to the fixation point nasally in each central field was a roughly oval scotoma of 7 by 5 degrees as determined by visual-field studies of the right eye, and 10 by 8 degrees in the left field. The blind spot shown by the left eye was irregularly enlarged to four times its normal size, and the peripheral field of the left eye presented a generalized constriction.

Cyanosis of the retina

Dr. Roy O. Riser. S. X., a nine-year-old boy, had been under observation for several years at Children's Memorial Hospital because of a probably congenital heart disease with a compensatory polycythemia. He did, however, present some findings of polycythemia vera, according to the department of hematology. He had the clubbed fingers characteristic of a congenital heart disease. The blood showed 7,030,000 erythrocytes per cubic mm. and 115 percent hemoglobin determination. Cyanosis of the face, lips, hands, and so forth, accompanied the flushing of the bulbar conjunctiva, and the typical retinal picture of very large dark veins, enlarged arteries of slightly lighter hue, and flushing of the discs and retina generally. Kodachrome fundus photographs accompanied the presentation.

Corneal leukoma—congenital persistent pupillary membrane

Dr. Roy O. Riser. J. L., a five-year-old Negro boy, had red eyes when two

months old, the left worse than the right. He had received treatment for one month in the rural part of Arkansas.

The right eye was normal. The patient had a convergent strabismus of the left eye of 40 degrees. There was a central dense deep corneal leukoma, 2.5 mm. in diameter, obscuring a golden-brown plaque, 2 mm. in diameter in the pupil. Running from this plaque to the collarette of the iris at the 2-o'clock and the 10-o'clock positions were golden-brown threads. A red reflex was barely discernible in the left eye.

Kahn and tuberculin tests gave negative results. Physical findings were normal. The slitlamp examination showed no signs of old interstitial keratitis. In addition to the aforedescribed pathologic changes the patient had an amblyopia. No treatment was advised.

Scientific program

History and development of the iris-inclusion operations

Dr. Thomas D. Allen presented a paper on this subject which has been published in this Journal (September, 1944).

Discussion. Dr. Sanford Gifford said that he had performed the operation frequently since 1927, when he reported a series of cases before the American Academy of Ophthalmology and Otolaryngology, and believes it to be one of the two most valuable procedures at their disposal in chronic simple glaucoma. The other procedures to be compared with it are, of course, Elliot's corneoscleral trephining and the sclerecto-iridectomy of Lagrange. In this hierarchy he felt inclined to place trephining first, iridencleisis second, and sclerecto-iridectomy third, although he recognized that many good surgeons, especially in France, prefer the last named and obtain results with it comparable to those with trephining.

A comparison of trephining and iridencleisis might be made as follows:

Advantages of trephining: (1) Great effectiveness in reducing tension, especially in the higher brackets, (2) round central pupil, and (3) little need for after care except the use of a mild antiseptic for life.

Disadvantages of trephining: (1) Greater technical skill and experience required. (2) More danger of certain complications, such as (a) wounding the lens capsule; (b) late infection; (c) prolonged hypotony; and (d) loss of central field.

Advantages of iridencleisis: (1) Simplicity of execution; it is undoubtedly the easiest effective filtering operation for the surgeon of moderate experience. (2) Less danger of complications: (a) wounding the lens capsule is exceedingly rare; (b) late infections are exceedingly rare; (c) prolonged hypotony is rare, the chamber being filled usually after 48 hours; (d) probably because of this fact, loss of the central field is rare. (3) Iridencleisis is generally effective in reducing tension to normal limits.

Disadvantages of iridencleisis: (1) It is probably less effective in reducing tension in the higher brackets. (2) Hence, more after care is required, including miotics and massage in some cases and occasionally a secondary operation. (3) The pupil is not round and may be slightly high. A really high pupil should never occur if Holth's simple technique is carefully followed, whereas it always occurs following the iridotasis of Borthen.

From this outline may be deduced the reasons for a set of indications for the two operations which have been gradually reached. As indications for trephining he said he considers the following conditions:

1. Cases of chronic simple glaucoma in which the tension cannot be reduced be-

low 40 mm. Hg (Schiötz) by miotics, provided the field is not cut down close to the fixation point.

2. Cases o very low-tension glaucoma in which the field is being lost while tension is seldom above 25 mm. Hg (Schiötz). This seems like a paradox, yet he said he believes that it is rational here to perform an operation which will reduce tension to the lowest degree possible.

As indications for iridencleisis the following conditions are usually considered valid:

1. Cases of chronic simple glaucoma in which the tension can be kept between 25 and 44 mm. Hg (Schiötz) by miotics.

2. Cases in which the tension is higher, but the field is cut down close to the fixation point.

3. Cases of hydrophthalmos. His preference for iridencleisis in this condition has come from a series of favorable results when the operation was performed early, and is supported by reports of cases in which trephining allowed the greatly stretched zonula to rupture during trephining, allowing fluid vitreous to escape and resulting in phthisis bulbi. He said that so far as he knew this has never occurred after iridencleisis.

As to technique, he believed the best procedure to be the simple iridencleisis of Holth, in which one meridional cut is made through the iris sphincter and the portion of iris next to this cut is turned out through the scleral incision and left beneath the flap. He said that everyone likes to make modifications in procedure, but the only ones he advocates in this operation are the use of the Foster Moore so-called water-tight suture and fixation forceps on the superior rectus. After injection of 4-percent novocaine, H. Gifford's forceps are placed on the superior rectus tendon through the intact conjunctiva as far back as possible, so as to give room for a very large conjunctival flap. A straight horizontal cut is made in the conjunctiva just in front of the forceps, long enough to extend past the limbus on each side. Dissection of the flap is made close to the sclera, but not so close as to wound the scleral vessels. It extends just to the limbus and is undermined to expose the whole upper limbus. While an assistant holds the flap down, a very sharp keratome is inserted 1 mm. from the limbus far enough to make an incision 5 mm. long. The surgeon holds the fixation forceps and cuts with the keratome directly against his fixation. The point of the keratome is raised as it is withdrawn and the iris usually follows it into the wound. It is grasped with iris forceps and withdrawn far enough so that the sphincter border is visible. This is cut with iris scissors and the portion held in the iris forceps is turned out under the flap with the pigmented side upward. It is not manipulated at all except for this maneuver. A few pats with a spatula on the cornea usually suffices to replace the remaining iris pillar and it is seldom necessary to introduce the spatula into the anterior chamber. A running conjunctival suture is then used to close the conjunctival incision with about 8 to 10 bites, enough to close the incision tightly, leaving an untied portion of suture at each end. Then, and not until then, is the fixation forceps released.

The suture is removed, after six days, from both ends, after one of the loops near the middle has been cut. Use of the water-tight suture seems to favor early refilling of the anterior chamber and early development of a filtering bleb. In the first 21 cases which, he said, he reported, there were no cases of delayed filling of the anterior chamber. There have been a few since that time, among several hundred operations, but they are certainly more rare than after trephining or after iridencleisis without the suture. This su-

ture was designed for use in corneoscleral trephining and is equally useful in that operation. The same may be said of fixation on the superior rectus, which ensures a large flap, perfect control of the eye during operation, and an opportunity for accurate closure of the conjunctival incision.

Robert Von der Heydt.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

November 18, 1943

Dr. Alfred Cowan, *chairman*

Diabetic cataract

Dr. George J. Dublin, by invitation, stated that diabetic cataract is a distinct clinical entity. Rollo is the first to be credited with speaking of cataract as a complication of diabetes. Generally speaking, it is subdivded into two types. The first type of the so-called diabetic cataract is found in the adult in association with diabetes mellitus. This type of cataract is a common finding, and is observed repeatedly in association with diabetes. It is similar in appearance to the senile cataract including the cuneiform, saucer-shaped, and nuclear types. Actually there is no differentiation, and it is impossible by any known method of observation to tell them apart, even by slitlamp microscopy. In both the senile cataract and the type of lens opacity found in the adult with diabetes, slitlamp microscopy reveals vacuoles, fluid clefts, and lamellar separation in the cortex together with various opacities in the lens. Gradle, in a series of 76 cases of diabetes, found lens changes in 41, with a blood sugar averaging 298.7 mg. per 100 c.c. of blood.

The second type of lens opacity is found in the diabetic under 35 years of age. This is the true diabetic cataract and it is this type that is referred to under the classification of diabetic cataract. It has been considered a rare condition. O'Brien, Mullsbury, and Allen reported a series of diabetic cataracts in patients under 35 years of age amounting to 16 percent. In 1942 O'Brien and Allen reported another series of cases in which they found 36 patients with cataracts out of a number of 260 cases under 21 years of age (13.8 percent). True diabetic cataract may assume one of the following pictures, but they all have the same characteristic in that the opacities are all subcapsular in location immediately adjacent to the subcapsular line. The common picture is the snow-flake type of O'Brien, subcapsular in location, whitish in color, and irregular in form and size and truly resembling snow flakes. The second type is the arrangement of the opacities as irregular large and small plaques together with fine dust-like opacities having a dirty-brown color, subcapsular in location, and strongly resembling the senile cuneiform type of cataract. The third type is the bluish-white opacity in which the lens may become completely opaque and swollen in one to three weeks (hydrops capsulae lentis). This is the malignant form of diabetic cataract. According to O'Brien and Allen lens opacities in young diabetics occur invariably in those whose diabetes has been poorly controlled or uncontrolled for several months. After standardization of the diabetes, these opacities may progress slightly but after six months of control the lens opacities generally remain stationary.

He presented the case of Mrs. M. R., a 22-year-old white woman. She was admitted to the Metabolic Department of Philadelphia General Hospital. She had

had diabetes for 10 years. She developed a sore throat six days prior to admission. A diagnosis of cervical adenitis and acute bronchitis was made. The main pertinent finding was that the blood sugar ranged from 245 mg. to 356 mg. per 100 c.c. of blood on the day of admission.

She had been receiving 60 units of insulin for an uncontrolled and unstabilized diabetes. Routine examination of the eyes was negative externally; eyegrounds were normal. Both lenses showed irregular dirty-brown opacities as large and small plaques involving the anterior and posterior subcapsular zones in both eyes. Some of these opacities were pointed, resembling the cuneiform type of senile cataract. There was a small clear area of cortex between the opacity and the subcapsular line. The remaining lens was entirely clear. The vision was 6/60 in each eye, corrected with glasses to 6/12 in each eye.

Discussion. Dr. Alfred Cowan said that O'Brien and his associates divide what they call diabetic cataract into two groups. The type that Dr. Dublin reported is in the group that includes those that resemble the senile disciform cataract. At first the opacity in this case would appear to be just in front of the posterior capsule, but with the narrow beam of the slitlamp it is seen to lie just behind the face of the adult nucleus, leaving a narrow space behind the posterior capsule. The space is so narrow, because at the age of this patient, 22 years, the cortex is very small. Usually opacities in the lens occur in the youngest zone, but they lie deep, down to the last surface of discontinuity.

In the case reported by Dr. Dublin, the opacity was disciform, yellowish gray, and similar in every respect to the ordinary senile type.

Dr. James S. Shipman said that in his experience diabetic cataract had been very rare. A patient under his observation for the past 15 years finally went blind, not from cataracts, but from diabetic retinopathy which was first to appear in his case and was quite gradual but definite. At present he is blind from the retinopathy, cataracts, and secondary glaucoma superimposed. So, diabetes does take its toll, and cataract is a definite complication. He said he believed that the criteria given by Dr. Dublin are as good as any; namely, the age of the patient, the history of diabetes in the presence of a high blood sugar, and the position of the opacities outside the embryonic nucleus.

Dr. H. Maxwell Langdon said he thought that Dr. Dublin was accurate in saying that it is difficult to tell diabetic cataracts from lens changes due to other causes. If the patient has a cataract and a high blood sugar with a spill-over into the urine, it is probable that the cataract is diabetic in origin; but it is doubtful whether in all such cases the cause of the cataract is the diabetes.

Many cataracts in young people remain unexplained. He said he had two such cases. The first patient was a 26-year-old woman with bilateral cataracts, who has been under observation for over five years. She had a careful physical examination with special reference to metabolic tests, and it was found that she had definite signs of hyperthyroidism. The thyroid was then operated upon. He said he thought that possibly some interference with the parathyroid caused the lenticular changes. There were no signs of diabetic changes whatsoever. The cataracts gradually advanced, and the vision of one eye was reduced to 2/60, so that the patient will undoubtedly require operation.

The second patient, a 37-year-old man, suddenly discovered that the vision of one eye was very defective. He was seen

the following day and the vision of this eye was limited to light perception. Examination revealed a practically mature cataract. The other eye was normal in all respects. He had been examined one year ago and his eyes were normal. A careful physical examination showed nothing to indicate such a condition. If either of these patients had diabetes, undoubtedly it would have been said that these were diabetic cataracts.

There are many elderly people who have ordinary senile changes in the lens, who also have an increase in the blood sugar and some sugar in the urine. These cases are usually classed as diabetic cataracts, and they may be; but it seems open to question whether or not the condition should be called diabetic cataract in a person with diabetes.

He said that he thought in the case presented by Dr. Dublin the cataract undoubtedly is due to the diabetic condition.

Dr. I. S. Tassman said that it seems there are other factors involved in the occurrence of cataract among these patients. The blood-sugar concentration, at any one time, in patients with diabetes is probably not the determining factor in the production of cataracts. Some diabetics have a high blood sugar and no cataract nor retinopathy. In others with a comparatively low blood sugar, cataract may be found alone or in association with retinopathy. These metabolic disturbances do not affect all patients in the same way. When a young patient with diabetes develops cataract, he said that he thought it should be called a diabetic cataract. However, there are certain unknown factors present, in addition to the blood sugar concentration, which are probably causative factors in the production of the ocular condition in these cases.

Dr. Solomon S. Brav said that he had seen in consultation with his son, a 14-year-old child who had diabetes. There were no signs of retinal pathology or diabetic retinopathy, but the vision was reduced to 2/200 because of the lens opacities. It was questionable whether or not the condition was congenital or diabetic. The child was operated on about one year later. The cataract in each eye was extracted and the resultant vision was 20/30 in each eye.

Dr. George Dublin, in closing, said that diabetic cataract in the young person should not present too great a problem in differentiating it from a congenital cataract. The various layers of the lens develop at certain periods of life, and congenital opacities of these layers have a typical location and appearance. For instance, if a congenital opacity is limited to the embryonal layer, it is evident that the opacity occurred at some time in the first three months of uterine life. If the opacity is in the fetal nucleus, it occurred between the third and eighth month of fetal life; and if it was in the infantile nucleus, then it probably occurred the first month after birth. The adult nucleus is developed about the age of 10 years and upwards, so, an opacity of that zone would indicate involvement at the age of puberty.

Congenital cataract, unless it is completely opaque with obliteration of all layers of the lens, would be comparatively easy to diagnose. The history of diabetes, and its rapid onset would be a big help in differentiation. It was mentioned before that there is a malignant type of diabetic cataract called "hydrops capsulae lentis." This is the bluish-white cataract that is present together with marked edema. He stated that this is, in his opinion, about the only type that might be confused with a total congenital cataract. The other types of diabetic cataracts progress slowly and do not mature with-

in several weeks, as has been stated at times.

In the case presented here the cataract had been present for about one year. A previous eye examination two years ago failed to reveal any lens opacity. O'Brien and Allen have brought out some interesting facts and figures. They claim that diabetics who have not been standardized are the ones that develop these cataracts. O'Brien states that if a period of six months or more elapses without good control, poor control, or without any control at all, the opacity is then likely to develop, and he further claims that if the case is under complete control or has been standardized for approximately six months, then rarely is there any further development in the cataract. After they reach a certain stage, they remain stationary.

Diabetic cataract is very similar, and may be confused with other endocrine cataracts, such as parathyroid and tetany cataracts. In this the location is very similar, and the opacities are in the deep portion of the cortex, but frequently they have a blue and green color. Other types of cataracts due to glandular disturbances are cretinism, myotonia, atrophica, and Mongolian idiocy. All these opacities are very similar in location and appearance, and without a history and physical examination, are extremely difficult to differentiate from diabetic cataract.

Epidemic keratoconjunctivitis

Dr. H. Maxwell Langdon, Dr. Van M. Ellis, and Dr. Robert D. Mulberger said that epidemic keratoconjunctivitis was first reported by Hogan and Crawford in 1942 (Amer. Jour. Ophth., September, 1942). It is characterized by congestion and swelling of the conjunctiva and lids; at times, a false membrane, more likely to be on the conjunctiva of the lower lid; frequent enlargement of the preauricular glands; and round or ovoid dots on the cornea just below Bowman's membrane which are highly refractile and may break down and show some slight staining.

Cases in the eastern part of the country have not differed from this description. The course of the condition is very irregular and there is no specific treatment although injection with convalescent blood has not been tried. In many cases there was a preëxistent slight injury or inflammation of the eye from a week or two weeks previously. Cultures show indifferent growth—usually diphtheroids or Staphylococcus albus.

Major Murray Sanders (MC) in 1942 reported the finding of a virus which produced encephalitis in mice, and after injection into a healthy man, who acted as a volunteer, produced a conjunctivitis; corneal complications, however, were not mentioned.

The corneal dots may entirely disappear or leave faint gray areas behind them. The cases they saw had complete recovery of vision to normal or better, although in one case it was reduced to 5/30 during the acute phase. In none of the cases were they able to trace any definite connection with an infected case. They regarded the corneal dots as the most definite diagnostic point.

Treatment consisted mainly of boric acid and holocain solutions for the discomfort; ice compresses for the swelling; tannic acid or silver nitrate for the catarrh of the conjunctiva; and in the later stages 10-percent boric-acid ointment for massage, which, they felt, aided in the clearing of the cornea.

They had 45 patients with corneal complications; 31 male, and 14 female. Both eyes were involved in 7 patients; the right eye in 23; and the left eye in 15.

Some of the most severe cases were

binocular, and it was felt that these patients were particularly susceptible. There were about 25 other cases which represented the conjunctival type of the condition, and in which there were no corneal complications.

Discussion. Dr. Edmund B. Spaeth said that Dr. Brealey presented an analysis of some 300 cases of this form of keratoconjunctivitis at the Academy meeting, in 1943. He emphasized the fact that when these patients recover, they usually continue their recovery. Also, their symptomatology may disappear, while they still have clinical signs of disease of the infiltrated cornea. For that reason the patient presented here is interesting.

This patient reported 10 weeks ago with a severe unilateral keratoconjunctivitis of the epidemic type. It was so severe that she had to be hospitalized. Ten days later she was out of the hospital, and 10 days afterwards, she returned to work. Six weeks later, she returned with the lids of the right eye swollen with edema, lacrimation, photophobia, and a sticky discharge. The condition was not a recurrence because she had not recovered, although she had apparently recovered for all clinical purposes, but six weeks later she had symptoms almost as severe as the first time.

He stated that, in his opinion, the best treatment is cold compresses in the early stages, heat later, adrenalin, and enough holocaine to keep the patient comfortable. Sulfathiazole proved of no value whatsoever. As a matter of fact, it seemed to cause irritation. Specific serum, if administered very early in the condition, relieves the symptoms to a marked degree, and apparently shortens the course of the disease.

Dr. A. G. Fewell said that during the keratoconjunctivitis epidemic he saw about 12 cases. His experience was the same as that of Dr. Langdon in that no two cases were in the same family. They came from scattered areas and all had glandular involvement. Mucopurulent secretion was not present in any of his cases, although there was considerable tearing and some ropey secretion. The majority of his cases were bilateral, and all but one had some involvement of the cornea. The one patient who had no involvement of the cornea was the only one who was given convalescent serum, and cure was effected within a week. The other cases were treated with holocaine and adrenalin. After the appearance of the corneal lesions, the majority of them were treated with Pregl's solution, which seemed to help clear up the corneal opacities a little more rapidly than those in which it was not used.

Dr. Solomon Brav said that in most cases there are chemosis and severe burning of the eyes. He had not seen any cases in which there was mucopurulent discharge. He stated that in his experience there has occurred a distribution of the infection in one family. It is probable in some cases that the mode of transmission is through the doctor's office.

Dr. Irving L. Pavlo said that at Wills Hospital there have been several hundred cases of this condition during the past year. There have been several waves of infection among clinic patients with glaucoma who have had their tensions taken at short intervals with the same tonometer which must have been insufficiently sterilized. Also, in the cataract wards there were several severe waves of infection, twice necessitating a quarantine. Most of the epidemiologic evidence pointed to an incubation period of 8 to 11 days, more often the latter. This was shortened in the case of the postoperative cataract extractions, in many of which

the full-blown disease appeared by the second or third postoperative dressing. It was interesting to note that none of these cases had any intraocular complications.

Dr. H. Maxwell Langdon said that for clearing up the corneal opacities a 10-percent solution of boric-acid ointment massaged on the eye and placed under the lids is beneficial.

External ophthalmoplegia

Dr. Van M. Ellis presented the case of a young Negro girl. She was first seen at the Presbyterian Hospital Clinic when she was 1½ years old, at which time the mother stated that both eyelids had been drooping for the past two weeks. Her case had been followed in the Clinic up to this time.

The findings when last seen were as follows: The vision of the right eye was 6/30, and of the left eye 6/12, with correction. The pupils were normal. The patient had a ptosis; complete third-, fourth-, and sixth-nerve palsies. The eyes were immobile and the right eye diverged about 20 degrees. The internal structures of both eyes were normal.

The neurologic report, other than the ocular findings already described, was negative. The pediatric consultation suggested that the condition was the result of congenital lues; however, repeated Wassermann tests had all proved negative. Palpable epitrochlear glands were present. There was, however, a definite family history of lues. Myasthenia gravis had been ruled out by therapeutic tests, prostigmine, and electrical reaction tests. Complete physical examination, including laboratory tests and spinal-fluid examination, was negative.

Hence, this was believed to be a case of external ophthalmoplegia, etiology undetermined.

Discussion. Dr. Walter I. Lillie said that this case was very suggestive of a congenital absence of the posterior longitudinal bundle, inasmuch as there was complete paralysis of ocular rotations of both eyes but pupillary reflexes were not involved. He suggested that caloric tests be done on this patient to see if nystagmus could be produced by stimulating the semicircular canals. If nystagmus is produced, it would show that there is still function in the posterior longitudinal bundle, and the lesion would be supranuclear.

Exudative choroiditis

Dr. I. L. Pavlo (by invitation) said that a 26-year-old man was seen at Wills Hospital on November 3, 1943. He complained of blurred vision of the right eye which occurred three weeks previously, or 10 weeks after onset of a typical pneumonia that had left a residuum of hoarseness and persistent cough with much tenacious, nonfoul, mucopurulent, blood tinged sputum. Visual difficulties began after a night of severe coughing.

The right eye showed small gray keratitic precipitates and aqueous flare. The lens was clear, the vitreous slightly hazy, and there was a light yellow-gray, 2½-D.D. exudate over the macula and disc, elevated 2 diopters. This area contained small hemorrhages, the veins were dilated, and perivasculitis was present. The visual field showed a 34 by 43 cm. caecocentral scotoma. The vision, R.E., was ¼/60.

Examination of the left eye was completely negative and the vision was 6/6.

Two badly carious teeth were extracted. An acute maxillary sinusitis was drained, yielding frank pus which, unfortunately, was not examined bacteriologically. Ten days later the sinuses were clear.

There were rales at the base of the left lung. X-ray study showed homogeneous

haziness over the left lower lobe, with some faint mottling, thought not to be tuberculous. The heart and blood pressure were negative.

The possibility was entertained that this was a typical chronic B. Friedländer pneumonia. B. Friedländer was found in pure culture in the sputum, which contained no acid-fast organisms. Successive sputa contained progressively fewer B. Friedländer in mixed culture; no typing was performed. Prostatic smear, urinalysis, serologic tests, blood sugar, sedimentation time, and brucellosis agglutination tests were negative as was hemocytology except for leukopenia of 4,500; 0.0002 mg. P.P.D. produced a 2+ reaction.

The patient had a subfebrile temperature which gradually fell to normal levels. His cough slowly cleared. The exudative choroiditis showed progression in extent and severity, at one point suggesting early proliferating retinitis.

The morphologic, cultural, manifold pathologic, and serologic properties of B. Friedländer or Bacillus mucosus capsulatus were discussed. The unusual, chronic type of pneumonia caused by this organism is quite consistent with the clinical picture presented by this patient. People in the younger age groups are found to have a definite resistance to the organism.

Investigations of the pathogenesis of uveitis rarely unearth evidence susceptible of scientific proof as attested to by Berens *et al.* in their negative blood, aqueous, and pharyngeal cultures including virus and brucellae in 91 such patients. Morphologic or cultural proof of actual uveal invasion of an organism is rare, as is evidence of direct irritation by bacterial endo- or exotoxins. Hypersensitivity to allergins produced by bacterial foci rests on evidence chiefly of a clinical nature, and admits of wide divergence of opinions as to the relative importance of pyogenic foci and tuberculosis and syphilis.

In summary, this patient with exudative choroiditis presented an unusual variety of possible etiologic factors, including a B. Friedländer pulmonary infection.

Discussion. Dr. W. E. Fry said that he examines these cases of exudative choroiditis very carefully in the hospital, and it has been his experience, and it probably corresponds to that of others, that in a number of cases the cause is not found, or that the cause of the ocular difficulty cannot be definitely ascertained. This case falls in just the opposite group. There are so many causes for the exudative choroiditis that any one can be chosen. The present findings, although not absolutely definite, suggest that the real cause is a pulmonary complication.

Epibulbar tumor—Case report

Dr. W. E. Fry presented the case of a 62-year-old woman who, in April, 1915, first noted a small pigmented lesion at the limbus of her left eye at the 1-o'clock position. In October, 1916, the lesion measured 4.5 by 2.5 mm. and extended 1.5 mm. onto the cornea. The nodule was excised in January, 1920, and the pathologic report was melanosarcoma. The nodule was excised a second time, and the thermophore was applied three times. The lesion recurred locally, and travelled about the limbus in a counter-clockwise direction. He stated that the patient then reported to him for treatment and the eye was enucleated in April, 1941. There was no evidence of metastasis and the patient remained well.

A pathologic report of the enucleated eye was made. The section of the eye revealed a deeply pigmented tumor mass near the periphery of the cornea. The mass in the section measured 3 mm. It

was composed of pigmented, elongated spindle cells. The nuclei were deeply stained and varied moderately in size. The associated inflammatory reaction was shown by clusters of polymorphonuclear cells. All of this tumor mass was superficial to Bowman's membrane. The tumor mass was partly divided by a band of dense connective tissue. All of the superficial portion of the cornea was involved to a varied degree by tumor cells. These were seen at places within as well as below the epithelium, and beneath superficial bands of connective tissue. A band of partly hyalinized connective tissue spread across the cornea above Bowman's membrane. Bowman's membrane was unbroken, and the stroma beneath it appeared normal.

The remaining portions of the eye were uninvolved with one exception; there was an unusual number of pigment granules in the corneoscleral trabeculae.

Conclusion. Certain portions of this report may be emphasized. The case described had been followed for 28 years. The tumor was of a type ordinarily considered highly malignant, melanosarcoma or malignant melanoma. In spite of the recurrences, final pathologic examination revealed that the corneal involvement was entirely superficial. There had been no distant metastasis—had there been this patient would have died years ago. The tumor apparently possessed only the property of local recurrence.

An additional point of interest is that, although the cornea under the microscope appeared remarkably clear, visual acuity was below 6/60. This is of importance in correlating experimental corneal disease, and the effective result of treatment.

Discussion. Dr. James S. Shipman asked Dr. Fry why radium was not used in the case reported, and what might have been the result if radium had been used. In most of the cases seen at the Wills Hospital irradiation before excision is advised and has been followed quite routinely for epibulbar growths. After excision, a correct diagnosis can be made, and further irradiation carried out if indicated.

He said that it has been stated that Colonel Ash thought irradiation unnecessary in carcinoma. He said that he would like to know why that is true, and if the same thing is true in cases of melanosarcoma.

Dr. Fry, in closing, said that this patient had been seen at the X-ray Department at the University and irradiation was contraindicated. He stated that he thought Dr. Shipman was quite correct as far as the opinion of some doctors is concerned. For instance, Dr. Reese in a recent discussion of treatment of precancerous melanosis of the conjunctiva recommends excision and irradiation by applying radon directly to the site of the growth.

Warren S. Reese,
Secretary.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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PSYCHOLOGY AND EYE EXERCISES

Every day, thousands of patients throughout the land ask their oculists for an opinion on the value of "eye exercises." These questions are based upon statements read in books or magazine articles; or upon the extravagant claims made by the least scientific and the least scrupulous of optometrists, or by practitioners of medical heterodoxies who see a chance to profit by public interest in the subject.

The average patient or parent asking such a question has only very faint notions as to a distinction between the application of the term "eye exercises" to the direct function of vision on the one hand, and its use with regard to the behavior of the muscles which move the eyeball, or to the function of binocular vision, on the other hand. It must be recognized, also, that some general physicians are not much more enlightened in this respect than the average layman. Yet the distinction is important.

In the popular press and the public mind, most of the recent trumpeting as to eye exercises relates to the supposition that optical defects of the globe, produc-

ing nearsightedness or farsightedness or astigmatism, may be corrected without the wearing of glasses, by resort to the so-called exercises advocated by Bates and his followers, of whom one of the latest is the visually handicapped novelist and essayist Aldous Huxley.

The public mind has displayed a much less significant interest in orthoptics, which aims to remedy defective control of the muscles that move the eye, or faulty association between the two eyes as to the function of binocular vision. This lesser display of interest depends mainly upon the fact that only a relatively small number of people are directly affected by the problem, whereas a very high percentage of the population is faced by the need for wearing glasses to compensate for errors of refraction.

Eye physicians have rather generally favored the attempts to improve external muscular control, and the function of binocular vision, by the type of eye exercises known as orthoptic training, although many eye physicians are still rather doubtful as to the frequency with which substantial and lasting benefit is derived from such training. The claims put forward as to exercises associated with the names of Bates and Huxley are condemned by the overwhelming majority of eye physicians as false, unscientific, and often dishonest. Eye physicians generally, from their understanding of the structure and physiology of the eye, know that it is ridiculous to suppose that any such system of eye exercises could so change the length of the eyeball or the curvature of its essential structures as to overcome the need for glasses to correct farsightedness, nearsightedness, and astigmatism.

At the 1943 meeting of the American Academy of Ophthalmology and Otolaryngology, Lancaster presented a paper under the title "Present status of eye exercises for improvement of visual function" (Archives of Ophthalmology, 1944, volume 32, page 167; also Transactions American Academy of Ophthalmology and Otolaryngology, 1944, 49th meeting, page 413). This paper has recently been made the subject of editorial comment in the Journal of the American Medical Association (1944, volume 126, page 771).

Lancaster emphasizes the fundamental biologic fact that repetition of an act facilitates its performance, tends to the acquisition of skill and efficiency. This principle underlies the practice of orthoptics, in which it is often necessary to replace faulty by correct habits of performance. As regards the function of binocular vision or the visual capacity of an eye which is anatomically normal, but in which poor visual acuity appears due to lack of use or lack of training of the eye and brain, the eye exercises of orthoptics may actually improve sight. To a certain degree this experience conflicts with the general rule that "the only way to improve sight is to get a better image on the retina."

The influence of cerebral training upon perception is seen in the daily phenomena of hearing, where faint sounds are recognized or interpreted through their associations. It is particularly manifest in the student of a foreign language, who may have an excellent knowledge of vocabulary and phonetics but may be utterly defeated in his efforts to grasp the sounds of the language as spoken by a native.

The same principle is illustrated in the experience of a highly intelligent blind person who has made a partial study of Braille but who tells us that he gets a false sense of competence from the fact that he is reading selections from the classics, with which he was long ago familiar, and therefore knows in advance what is coming. Give the same student of

Braille an entirely "unseen" and unfamiliar passage, and he is lost.

Lancaster's paper dismisses in very few words the structural changes, apart from those in the external muscles, which are claimed to result from "eye exercises." "Frankly," he says, "I am skeptical of such an effect." He quotes the saying of Jesus: "Which of you by taking thought can add one cubit unto his stature?" Yet the article contains two or three statements which are likely to be lifted out of their context and applied in support of the Huxley-Bates point of view. Thus we have the aphorism: "Seeing is only half ocular; the other half is cerebral." We are further told that "buried in a mass of what to ophthalmologists seem foolish gestures and performances, best defined as hocus-pocus, there are sound and fruitful ideas." Also, as to the cerebral part of ocular synthesis, it is suggested that "ophthalmologists have neglected this field and have concentrated their attention on the primary source of sensation, the image on the retina, leaving to irregular, untrained workers the cultivation of that field." The facility with which such statements may be made to assume a detached and exaggerated significance is illustrated by the fact that the short editorial comment in the Journal of the American Medical Association dwells chiefly upon these very passages from Lancaster's paper.

As the present writer has pointed out (American Journal of Ophthalmology, 1943, volume 26, page 202), "such parts of Huxley's volume as have any value at all have been lifted from the works of writers on psychology." The same is true of other advocates of the Bates system.

Physicians, outside the ranks of the psychiatrists, are pretty well accustomed to being told that they do not devote sufficient attention to the importance of psychic or psychologic influences. But it is probable that most physicians do give more or less attention to this factor in health and disease. They could hardly be successful in handling patients if they completely ignored mental influences. On the other hand, it is possible to attach too much importance to the psychic factor. Certainly a good many followers of another eminent Bostonian carry to a ridiculous degree the emphasis on mind and a professed disregard of the material basis. The act of walking might be described as one half muscular and the other half neural and cerebral. But wasted muscles cannot produce the act of walking, no matter how perfect the nerve action or how keen the volition. In a superlative degree, good sight depends upon accurate retinal function, which in turn is influenced by the structure of cornea and lens and the length of the eyeball.

W. H. Crisp.

EYE CARE FOR OUR RETURNED SOLDIERS

All ophthalmologists are interested in the quality of the treatment being given to the wounded and diseased eyes of our returning soldiers and sailors. Col. James Greear gave a very reassuring talk on the subject as it pertains to the war blinded at a dinner at the last meeting of the American Academy of Ophthalmology and Otolaryngology. At the end of October the writer had the privilege of visiting the O'Reilly General Hospital at Springfield, Missouri, where he saw what was being done for ocular injuries and eye diseases in our soldiers from overseas. This is one of eight general hospitals that have been designated for the care of these eye cases in addition to certain other types of special work.

A good train service connects this Hospital with Saint Louis and points East, but patients are for the most part, trans-

ported to the Hospital by air, landing from ambulance planes at the nearby airdrome. They arrive from the battle fields of Europe in a surprisingly short time, often only a matter of a few days after the injury or illness is incurred.

About 250 beds of this 3,500-bed Hospital are assigned to ophthalmic patients; of these some 135 were in use on the day of the writer's visit. The Hospital is composed of a series of connecting one-story buildings of frame and composition construction. They are equipped with every modern device that would assist in the diagnosis or treatment of patients. The operative set-up is of the best, but most important of all is the well-trained personnel of the staff assigned to the care of eye patients.

The organization is fortunate in having as Commanding Officer General Foster, who has an advanced point of view as regards the whole enterprise. He has surrounded himself with capable young men and has inspired in them a fine *esprit de corps*. The eye service is also fortunate in that Lt. Col. Edward P. Burch, II, is assistant to the General, because Colonel Burch is a well-known ophthalmologist who, therefore, has an especial interest in the eye patients, although no longer in charge of the ophthalmic division. This position is now held by Major Perry, another capable ophthalmologist. Under him are Captains Swift and Sherman. The latter has responsibility for the ophthalmic plastic surgery of which there are many cases. There were approximately 40 patients undergoing this type of reconstruction at the time of the October visit. Dr. Sherman, having been trained by Dr. John M. Wheeler, was using the methods advocated by him and was doing excellent work.

One of the major eye problems in these base hospitals, where definitive treatment is carried out, is that of uveitis; many cases are seen and every opportunity for complete studies of them is offered. This was the subject of Captain Swift's paper at the evening meeting, where he discussed 100 cases of this malady. The afternoon clinic included many patients suffering from uveitis. The etiology seemed to differ little from that found in civil life, and, unfortunately, recovery was just as slow and uncertain.

At O'Reilly General Hospital very fine work on the construction of artificial eyes from acrylic material is being done by Major Hahn of the Dental Corps. These eyes are tailormade for the patient. Excellent fits are possible because of the molding of the model in the socket. Life-like irides are painted on plug buttons which are embedded in the molds in the correct situation. Conjunctival vessels are cleverly imitated by variously colored nylon threads planted in the "scleral" surface. When asked how fragile these eyes were Major Hahn responded by throwing one of them at full force on the composition floor. It bounced 8 to 10 feet and on recovery showed no sign of the abuse. Major Hahn says that there are still some "bugs" in the process but all can probably be removed.

Taken as a whole and in every detail, ophthalmologists can rest assured that if the other seven ophthalmic bases are on a par with the O'Reilly General Hospital in care of ophthalmic cases the very best attainable is being done for our soldiers.

Lawrence T. Post.

BOOK NOTICES

THE ROMANCE OF MEDICINE. By Benjamin Lee Gordon. Clothbound, 864 pages with index and many illustrations. Philadelphia, F. A. Davis Co., 1944. Price $5.00.

This volume should be of special in-

terest to the ophthalmologist because of the large role that eye diseases and superstitions play in the history of medicine.

The author has unearthed an amazing amount of folk-lore and historical facts about the art of healing. He has also selected an unusually pertinent collection of illustrations. No physician can fail to find much that is of great interest in the book. Undoubtedly, in such a compendious undertaking there are a number of errors, but these are of minor significance because the treatise is written presumably with the primary intention of creating interest rather than as a reference book of encyclopedic accuracy.

The chapters divide the subject perhaps a little artificially, but it is difficult to maintain an over-all continuity in a work of this kind. The reader found the book not one to be consumed from cover to cover uninterruptedly, but this is an end almost impossible of attainment in these days when every newspaper contains material so thrilling and so vital that literature other than current has difficulty holding the attention at all. Notes on each chapter precede the index.

"The romance of medicine" will be found a pleasant diversion as well as a means of agreeably enlarging one's knowledge of interesting facts in the development of medicine. Perhaps it will be most enjoyed as a book to be picked up intermittently for an hour or two's reading. The author and publisher are to be congratulated on the splendid appearance of the volume at a time when most books are made of such poor material and have such blurred illustrations that there is little hope of their survival in the libraries of the future.

Lawrence T. Post.

OFTALMIA SIMPATICA (SYMPATHETIC OPHTHALMIA). (In Portuguese.) By Octacilio de C. Lopes. Paper covers, 146 pages, 13 illustrations, Livraria Atheneu Jose Bernades, Rio de Janeiro, Brazil, 1944. Price not stated.

This well-arranged and clearly written monograph consists largely of a review of the world literature of the subject, with three important chapters devoted respectively to etiology, pathogenesis, and pathologic anatomy. A chapter of fourteen pages is devoted to circumstantial accounts of a number of cases from the author's personal experience.

W. H. Crisp.

CORRESPONDENCE

Ophthalmology in Paris

November 22, 1944

Editor, American Journal of Ophthalmology:

The first meeting of the Société d'Ophtalmologie de Paris since the Liberation was held at the Faculté de Médecine on the 31st of October, 1944. Those present were Drs. Favory (president), Prélat (secretary general), Bégué, Rollin, Guillaumat, Voisin, Desvignes, Bailliart, Légard, Chappé, Gallois, Offret, Bruneau, Kalt (the younger), Lavat, Nectoux, Mérigot, Dubois, Charpentier, Dollfus, Blum, Bollack, and Coutela. Col. Derrick Vail, Senior Consultant in Ophthalmology, E.T.O., U. S. Army, was the guest of honor. The program consisted of the following case reports and papers. "A case of grippotyphosa leptospirosis with ocular complications," by Drs. Dollfus and Denechau; "A case of severe bilateral phototraumatic retinitis in a wounded soldier," by Dr. Dollfus; "Barbituric amaurosis with evolutionary accidents," by Drs. Offret and Ardonin; and "Spontaneous detachment of the choroid—a rare complication of furunculosis," by Dr. Hébert. Dr. Fa-

vory graciously welcomed the American ophthalmologists and invited them to attend all future meetings. There was much discussion over ways and means by which the Society could help their distressed members and confrères who had suffered loss of equipment and supplies during the Battle of France. Colonel Vail extended the sympathy of the American colleagues and requested information so that some measure of assistance might be given by the ophthalmological societies of the United States.

Undisturbed by the Huns, the Society held its meetings regularly during the occupation. Its famous Bulletin, however, could not be published due to lack of paper and authority. Several of its members suffered personal harm and damage at the hands of the unspeakable Hun. The relief of freedom and an electric feeling of joy pervaded the group.

The following is a note which Dr. Magitot wrote at my request giving information regarding his activities during the German occupation of Paris. I think this will be of interest to us in the Journal.

"Dr. Magitot sends all his American friends his kindest regards and best remembrances. He is now back in Paris. He was considered by the Germans to be a Jew by his marriage, and consequently his home, estates, books, and professional equipment were seized. To avoid deportation, all of his family scattered and had to hide during the four years. Now that liberation has come, he believes he must rejoice to find himself, wife, and children still alive.

"The eye department in the Lariboisiere Hospital, where he used to work, and the Rothschild Foundation of the Rue Marin, have been taken and plundered. It will need much time before these clinics can be run again.

"The Annals d'Oculistique is planning to issue a first number in January, 1945, if paper is available. During these past years in exile from Paris, Dr. Magitot has written a 'Clinical physiology' which is now being printed by Masson et Cie. Another book 'Textbook on ophthalmology,' written with Dr. Bailliart, is ready but cannot be published until paper is obtained.

"Anxious to know about the ophthalmologic activity in the States during this war, Dr. Magitot would highly appreciate it if his American colleagues would send him reprints. He is happy that he will hear from his American friends as soon as regular mail is restored."

(Signed) Derrick T. Vail.

On divergence excess and postural tonus

To the Editor:

Captain Posner, in the October number of the Journal, deals with some important aspects of ocular motility but does not carry through his thinking with complete consistency perhaps because he is still under the spell of the old ideas which he is aiming to correct.

He takes as his text a case of anisometropia: O.D. +0.25 cyl. approximately emmetropic; O.S. fairly high H. As was to be expected, the tests for heterophoria give different results according to which eye is made to fixate, the tests being made without glasses. When the emmetropic right eye fixates there is no accommodation required and therefore no impulse to converge excited by accommodation. The phoria is an exophoria which is the true or underlying phoria uninfluenced by other reflexes than the basic tonus reflex and the fixation reflex from the right retina. When the hypermetropic left eye fixates a large amount of accommodation is required (probably 3D., as 2.50D. was found with the partial cycloplegia pro-

duced by homatropine, no test of accommodation at the time of measuring the refraction being recorded—unimportant perhaps). The effect of this accommodation of over 2.50D. is to excite a corresponding convergence. Result: esophoria. A not unusual finding. (If tested with correction it is certain that the correction left some uncorrected H for the accommodation to take care of.)

It is surprising that Captain Posner says nothing about this factor of the accommodation reflex as he was emphasizing the importance of the reflexes which he rightly lists as these: (1) the underlying tonus, (2) the fixation which includes the focusing, (3) the fusion. He might have cited the tendency of tonus to hold over. Thus if a person with no hyperphoria is made to wear a prism 2^{Δ} base down for a few hours he will show a hyperphoria for some time thereafter as the tonus required to overcome the prism persists. Similarly the accommodation necessitated by H tends to persist.

He rightly stresses the importance of abandoning the notion of position of rest. And yet he does not consistently use the preferred term fusion-free-position probably as a concession to custom. He says: "there is a characteristic 'position of *rest*' for each state of *activity* of the central nervous system" (italics mine). Obviously rest is the direct antithesis of activity. Nor does he carry through the correction of this mistaken idea of a position of rest to include the mistaken but widely prevalent idea of mechanical or anatomical factors being the fundamental cause of most cases of heterophoria and heterotropia instead of only a few.

Bielschowsky made many valuable contributions to our understanding of ocular motility and binocular vision but his mistaken conception of a position of rest (modified later to a relative position of rest) with its corollary of the anatomical or mechanical basis of most phorias and trophias must be abandoned if we are to achieve a sound logical conception of this important subject.

I commend the following references to Captain Posner; there are passages in each of them confirming his views on position of rest and on reflexes and carrying them farther than he has done:

"Physiology of disturbances of ocular motility," Arch. of Ophth. v. 17, p. 983.

"Detecting and interpreting ocular deviations," Arch. of Ophth. v. 22, p. 867.

"Ocular motility," Amer. Jour. Ophth., v. 24, pp. 485, 619, 741.

"Terminology in ocular motility," Amer. Jour. Ophth., v. 26, p. 122.

Walter B. Lancaster, M.D.
Boston, Mass.

Corrections

November 10, 1944

Editor, American Journal of Ophthalmology:

The following errata appeared in my paper "Backflow phenomena in aqueous veins."

On page 1078, in table 2, the number of "negative eyes" should read 30 (namely 23 plus 7), not 20.

On page 1088, ninth line from bottom of page: instead of "2. that along the convex border," should read: "2. that along the concave border." The word "convex" in the neighboring line, however, is correct.

(Signed) K. W. Ascher.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

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CORNEA AND SCLERA

Krutova, A. H. **Sulfanilamide in the treatment of corneal ulcers.** Viestnik Oft., 1943, v. 22, pt. 3, p. 43.

In the treatment of corneal ulcers Krutova found local application of sulfanilamide powder more effective than the application of any other therapeutic agent. It cleanses the cornea of purulent infiltrates, and pain is relieved in one day. The drug has no effect on hypopyon, which may continue to increase in spite of the fact that the ulcer is getting clean. Final cicatrization of the ulcer is delayed longer than usual, and epithelization still longer. Apparently sulfanilamide retards the regenerative process. Ray K. Daily.

Scholz, R. O. **Unsuccessful treatment of syphilitic interstitial keratitis with sulfanilamide.** Arch. of Ophth., 1944, v. 32, July, pp. 68-69.

In view of the conflicting reports in the literature, four patients with congenital syphilitic interstitial keratitis were treated in the Johns Hopkins Hospital with ordinary antisyphilitic therapy plus sulfanilamide in large doses. In none of the cases was there any significant improvement which might be attributed to this therapy. One of the patients was also given a second course of treatment with sulfanilamide plus riboflavin, without result. The four cases are reported individually. (References.)

R. W. Danielson.

Strakov, V. P. **Ophthalmic successes in corneal transplantation.** Viestnik Oft., 1942, v. 21, pt. 6, p. 28.

The wide application of corneal transplantation dates from 1924, when Filatov and his coworkers at the Ukraine Research Institute began to work on the technique of the operation, and interested a number of ophthalmologists in the work. They developed a suitable instrumentarium, and issued numerous publications on the various aspects of this type of surgery.

Ray K. Daily.

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UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Figueiredo, N. P. de. **Subsalicylate of bismuth in treatment of luetic internal ophthalmoplegia.** Rev. Brasileira de Oft., 1944, v. 3, Sept., pp. 3-11.

A white soldier aged 25 years, suffering from severe dental caries, noticed in the right eye a disturbance which interfered with vision for close work. The right eye showed vision of two thirds for distance, but needed plus 3.25 sphere to obtain normal vision at the reading range. The left eye had normal vision for both distance and near. In the right eye the pupillary reflex to light and accommodation, both direct and indirect, was absent. All these reflexes were normal in the left eye. Attention was first directed to the diseased teeth, but no improvement had occurred after an interval of one week. The Kahn blood test proved strongly positive, and the patient was given a course of intramuscular injections of subsalicylate of bismuth, one c.c. weekly. Improvement was noted soon after the sixth injection, and the Kahn test was then negative for the first time. Four days after the tenth injection, the Kahn was still negative, and vision was normal for both near and distance, with normal pupillary reflexes. W. H. Crisp.

Kinsey, V. E., and Grant, W. M. **The secretion-diffusion theory of intraocular fluid dynamics.** Brit. Jour. Ophth., 1944, v. 28, July, pp. 355-361.

This paper is a recapitulation of the authors' theory of intraocular fluid dynamics, and a discussion of criticisms made by Duke-Elder and Davson of the mathematical concepts used in developing the theory.

It was found that the total water movement into and out of the anterior chamber of the rabbit was approximately fifty c.mm. per minute, a rate far in excess of what was thought to be the rate of formation of the aqueous humor as a whole. This is believed to suggest that perhaps the various constituents of the aqueous humor may enter the anterior chamber at different rates. To test this hypothesis, the rates of accumulation of various substances in the anterior chamber were determined, as was also the concentration of these substances in the plasma. It was found that electrolytes entered the anterior chamber as a result of secretion, while nonelectrolytes entered by diffusion. It is believed that both electrolytes and nonelectrolytes leave the anterior chamber by a process of flow. (References.) Edna M. Reynolds.

Wagener, H. **Toxoplasmic chorioretinitis.** Amer. Jour. Med. Sciences, 1944, v. 208, Aug., p. 255.

The rather recent discovery that the toxoplasma, a highly organized protozoan parasite, can invade the tissues of the eye and cause destructive lesions of the choroid and retina, has introduced further complexity into the etiologic study of chorioretinal disease. The author reviews cases from many references, with opinions of various authors on the subject, and particularly quotations from a recent article by Vail. There is a predilection for the macular area, and the lesions are usually bilateral and multiple. Diagnosis from the ophthalmoscopic appearance alone appears indefinite. The decision may depend upon demonstration of neutralizing antibodies in the blood serum. A positive complement-fixation reaction does not in all cases indicate active or even recent infection. There

seems to be no very satisfactory treatment, though various forms of sulfonamide have been tried.

Theodore M. Shapira.

8

GLAUCOMA AND OCULAR TENSION

Ascher, K. W. **Backflow phenomena in aqueous veins of normal and of glaucomatous eyes.** Amer. Jour. Ophth., 1944, v. 27, Oct., pp. 1074-1089. (4 figures, 3 tables, 3 in color, references.)

Bertotto, E. V. **Chronic simple glaucoma.** Anales Argentinos de Oft., 1943, v. 4, Oct.-Nov.-Dec., pp. 152-166.

The author accepts Magitot's inclusive definition of chronic simple glaucoma as an affection characterized by a particular optic nerve atrophy, circulatory modifications, and intraocular hypertension. Among disputed initiating factors are endocrine instability and neurovegetative derangement. The theories of pathogenesis include the circulatory, the hypersecretive, and the theory of diminished fluid absorption (or mechanical theory). There are found differences of opinion as to whether to operate early or late. The author feels that surgery is definitely indicated when the visual fields continue to contract in the face of topical medical care. (One table, fields).

Edward Saskin.

Evans, J. N. **The macula-wedge scotoma a prognostic index in glaucoma.** Amer. Jour. Ophth., 1944, v. 27, Oct., pp. 1090-1093. (2 figures.)

Gartner, S., and Lambert, R. K. **Tenotomy of the rectus muscles in glaucoma.** Amer. Jour. Ophth., 1944, v. 27, Nov., pp. 1228-1231. (References.)

Hess, Leo. **Pathogenesis of acute glaucoma.** Arch. of Ophth., 1944, v. 32, Aug., pp. 128-132.

According to the author, acute glaucoma may be viewed as a vegetative neurovascular crisis. Other examples of this kind of crisis are epileptic seizures and attacks of cardiac asthma associated with acute edema of the lungs. The ciliary ganglion and the vegetative diencephalic center at the base of the brain (the Karplus-Kreidl center) are thought to play predominant roles in the nervous mechanism of glaucoma. The increased intraocular pressure and many other signs of acute glaucoma are secondary to the central irritation. The congestion of the conjunctival blood vessels, chemosis, edema of the lids, and changes in the cornea commonly regarded as inflammatory, are really of angioneurotic origin. The pharmacologic aspects of this concept are discussed. (References.)

John C. Long.

Paulo, A., Jr. **Late suppurative infections after fistulizing operations.** Rev. Brasileira de Oft., 1943, v. 1, June, pp. 193-208.

Two cases are recorded. The first patient, aged fifty years, underwent an Elliot trephining, followed by a small cyclodialysis through the scleral opening. The patient refused removal of a dental abscess. After six weeks he returned with acute signs of uveitis, including cloudiness of the anterior chamber, a small hypopyon, and a purulent appearance of the cystoid scar. The tension, previously normal or less, had risen to 22 mm. (Schiötz). A variety of medicinal and surgical procedures proved ineffective, and the eye had to be enucleated in a condition of painful atrophy, with suspicion of

sympathetic ophthalmia in the other eye.

The other patient, a man of 72 years, also underwent an Elliot trephining. Many months later he returned with an acute uveitis. Bacteriologic examination revealed the presence of a hemolytic streptococcus. In this patient, also, a dental abscess was found after the development of the acute inflammation, but evisceration proved necessary in spite of extraction of the tooth. (2 drawings.) W. H. Crisp.

Pletneva, H. A. **Contributions to the study of glaucoma during the last twenty-five years.** Viestnik Oft., 1942, v. 21, pt. 6, p. 21.

A review of the contributions of Russian ophthalmologists in this field. Maslennikov was the first to call attention to the diagnostic importance of the daily tension curve. Samoilof described the variations in the size of the blind spot under the influence of pilocarpine, and made a comprehensive study of hypertension as a reaction to pain. Kamenetzki described an unusual form of glaucoma, observed in the Irkutsk district; it occurs only in young men, is associated with atrophy of the iris, and is inherited. Pilman studied the influence of the thyroid on glaucoma. In 99 percent of the glaucoma patients he found hypothyroidism, and the blood serum of these patients added to atropine produced maximum dilatation of the pupil. Blood serum of hyperthyroid patients inhibited the action of atropine. Fradkin, in a study of the mechanism regulating intraocular tension, pointed out the importance of conditioned reflexes. Impulses from the cortex may change so fundamental a property of cells as their permeability. The reflex rise in intraocular tension in response to a conditioned reflex indicates cerebral participation in the regulation of intraocular tension. Maklakov was the first to conceive the idea of a subconjunctival fistula in the treatment of glaucoma. Filatov demonstrated the effect of muscular exercise on intraocular tension. From Kravkov's laboratory of physiologic optics came interesting data on the effect of white and green illumination on intraocular tension.

Ray K. Daily.

Promtov, B. A. **A new miotic—proserin.** Viestnik, Oft., 1943, v. 22, pt. 3, p. 33.

To encourage the production of proserin, which is the Soviet drug with the chemical formula of prostigmin, the author reports its effect in clinical cases. The conclusions based on the clinical applications are that a 5-percent solution instilled into the conjunctival sac produces contraction of the pupil, and reduction of intraocular tension in glaucomatous eyes. In some cases the pupil contracts but intraocular tension remains uninfluenced. This drug does not produce the painful sensation in the eyes and temples sometimes caused by eserine.

Ray K. Daily.

Reese, A. B. **Deep-chamber glaucoma due to the formation of a cuticular product in the filtration angle.** Amer. Jour. Ophth., 1944, v. 27, Nov., pp. 1193-1205. (14 illustrations, references.)

Wolfe, O. R., Wolfe, R. M., and Georgariou, P. **Glaucoma—sclerectomy, external and suprachoroidal drainage.** Amer. Jour. Ophth., 1944, v. 27, Oct., pp. 1146-1148. (5 drawings, references.)

9

CRYSTALLINE LENS

Bailey, J. H. **A modification of the corneal section in the operation for cataract.** Amer. Jour. Ophth., 1944, v. 27, Nov., pp. 1253-1257. (2 figures.)

Lawes, F. A., and Halliday, J. C. **Marfan's syndrome: arachnodactyly with dislocation of the crystalline lens.** Med. Jour. Australia, 1944, v. 1, May 20, p. 465.

After an introduction regarding the history and symptoms of the disease, the authors report three cases in one family. A woman aged 52 years had "trouble with her spine" at the age of seven years, and now has a dorsal curvature of the upper thoracic portion of the spine, so that she is at present 5 feet 9 inches as against earlier 5 feet 11 inches. The sternum is unduly prominent, the hands and feet much elongated. Each forefinger measures 4 inches, the second finger 5 inches, the third 4½, the fourth 3 inches. The length of the great toe is 3½ inches, that of the second toe also 3½ inches. X-ray examination of the thoracic part of the spine reveals a destructive lesion (probably healed tuberculosis) at the level of the seventh thoracic vertebra. The patient is now in good health. Her ocular conditions are: pronounced iridodonesis, dislocation of the lenses upward, visual acuity 6/36 and 6/24 unimproved by glasses. A girl aged 14 years, otherwise well built, has rather long fingers. When her pupils are dilated iridodonesis can be observed, with slight dislocation of both lenses upward. She has compound myopic astigmatism, and with correction her visual acuity is 6/9. The third patient, a boy aged six years, looks older than his age and his face longer than in normal proportion. Notable features are long fingers and toes and winged scapulas. The chief complaint was of bad vision, and on examination pronounced iridodonesis was found, with dislocation of both lenses upward.

M. Lombardo.

Lijó Pavía, J., and Morate, F. H. **Senile cataract and vitamin C.** Rev. Oto-Neuro-Oft. 1944, v. 19, May-June, pp. 84-88; also La Semana Med., 1944, v. 51, Aug., pp. 275-277.

This short paper is a sequel to one written by Lijó Pavía seven years ago. The majority of cataract patients have a vitamin-C deficiency, and the elderly require more vitamin C than the young. The authors administer vitamin C perorally, intravenously, and in certain cases into the anterior chamber. In their series of selected cases of immature senile cataract, definite improvement in visual acuity was noted after vitamin-C treatment. In cases of mature cataract, however, the improvement was slight and was seen in but a few instances. Edward Saskin.

10

RETINA AND VITREOUS

Arruda, Jonas de. **Comments on gravidic retinosis.** Rev. Brasileira de Oft., 1943, v. 1, June, pp. 223-232.

Three cases are described. A woman of 28 years, previously normal, developed an acute nephritis at three months of pregnancy. The vision of each eye was one fortieth, the arterial pressure 190/120 mm. The fundi showed numerous exudative lesions, with intense retinal edema and a number of hemorrhagic foci. The ocular condition improved rapidly after surgical termination of the pregnancy, the

vision rising to right 9/10, left 8/10. But the nephritis advanced and the patient died about six months later.

The second patient, a woman of 32 years, had been found in normal condition shortly before the end of her third pregnancy. Fifteen days before the birth of the child, she noticed a rapid falling off in the vision of the left eye, the only eye in which it was possible to see the fundus or which had previously possessed good vision. The patient had the usual symptoms of headaches, dizziness, and vomiting. After parturition, she was given intense antiluetic and vitamin treatment, without result. The vision of the formerly good eye was reduced to counting fingers at one meter, and the fundus showed extensive disturbance of the macular area, including white spots and discrete pigmentation. Nine months later the eye developed a retinal detachment. (References.)

W. H. Crisp.

Brickner, R. M. **Visible retinal arteriolar spasm associated with multiple sclerosis.** Arch. Neurol. and Psychiatry, 1944, v. 51, June, p. 573.

The authors have noted a phenomenon, associated with multiple sclerosis, which so far as they know has not been previously described. In association with abrupt attacks of visual impairment consisting of shimmering and the presence of multiple dark areas, spasm of the retinal arterioles could be seen on examination with a Morton ophthalmoscope. In two cases of multiple sclerosis, spasm of the retinal arterioles was coincident with the presence of scotomas. When the scotoma receded or disappeared, the spasm also disappeared; this change followed immediately the inhalation of amyl nitrite in one case and was spontaneous in the other. In a third case, attacks of blurred vision were promptly relieved by inhalation of amyl nitrite.

Theodore M. Shapira.

Goldberg, S., and Newell, F. W. **Sarcoidosis with retinal involvement.** Arch. of Ophth., 1944, v. 32, Aug., pp. 93-96.

The iris is very commonly involved in sarcoidosis whereas infiltration of the choroid and retina is rare. The authors report two cases of sarcoid with fundus lesions. The first patient was a 23-year-old Negro male who had noticed nodular swellings in both inguinal regions, followed by enlargement of the parotid, posterior cervical, axillary, subclavicular, and epitrochlear glands. A marked reduction in vision of the right eye was noted. The right eye showed much pigment and many blood cells in the anterior portion of the vitreous. There were many deep and superficial retinal hemorrhages, with thrombosis of the superior temporal vein. The macular area was edematous. Six weeks later, a white mass, extending 3 diopters into the vitreous, was present at the inferior nasal margin of the disc. The mass was superficial to the retinal vessels but was overlain by many new vessels. Chest X-rays showed adenopathy of the hilar nodes of both lungs and a generalized increase in lung markings. Biopsies of the enlarged lymph glands are typical of Boeck's sarcoid.

The second case was found in a 24-year-old Negro male. There was marked parotid swelling, swelling in the upper outer angle of the orbits, cervical adenopathy and subcutaneous nodules in the arms and forearms. The right optic disc was obscured in the inferior nasal quadrant by a grayish-

white mass approximately 2 disc diameters in diameter and extending nasalward. The mass overlay the retinal blood vessels and projected 4 diopters into the vitreous. Subhyaloid and retinal hemorrhages were present. Biopsies from the enlarged glands were somewhat atypical but were interpreted as representing sarcoid of the Darier-Roussy type. (References.)

John C. Long.

Guerry, DuPont, 3. **Congenital retinal folds.** Amer. Jour. Ophth., 1944, v. 27, Oct., pp. 1132-1135. (One illustration, references.)

Lijó Pavía, J. **Diathermic surgery of the retina.** La Semana Méd., 1944, v. 51, Sept. 21, pp. 606-610.

Two cases are reported, one of retinal detachment successfully treated with diathermy puncture, the other a case of Coats's disease (retinitis exudativa externa), in which the progress of the retinal disease appears to have been arrested by a similar delimiting use of the method, somewhat as recorded by Lewis, and in discussion by Guyton (Trans. Amer. Acad. Ophth. and Otolaryng., 1943, May-June, pp. 357 and 360). (References.)

W. H. Crisp.

Lijó Pavía, J. **Senile degeneration of the retina.** Rev. Oto-Neuro-Oft., 1944, v. 19, May-June, pp. 73-81.

The senile retinal change most often seen is atrophy of the outer layers of the retina, making readily visible a red, sclerotic choroid. Cystoid degeneration, macular degeneration and holes, and paramacular changes follow in order of frequency. Less frequent are pigmentary derangements such as the salt-and-pepper fundus, or pigmentary clumping, and senile exudative macular lesions. Three cases are reported representing respectively choroidal sclerosis and pigmentary atrophic changes, hypertensive and sclerotic retinal and choroidal lesions, and retinal endarteritis with partial obstruction. The accompanying serial retinographs are excellent. All three cases were given, among other things, vitamin-C therapy. Edward Saskin.

Lyle, D. J. **The association between retinopathies and encephalopathies in the common cardiovasculorenal affections.** Amer. Jour. Ophth., 1944, v. 27, Nov., pp. 1232-1252; also Trans. Amer. Ophth. Soc., 1943, v. 41, p. 541. (2 charts, 44 figures.)

Rebelo, Orlando. **Regarding circinate retinitis.** Rev. Brasileira de Oft., 1943, v. 1, June, pp. 213-218.

A woman aged 35 years had normal visual acuity in the right eye, but only one eighth in the left eye. The macular area of the left eye showed grayish spots, and the lower half of its circumference had a halo of milky-white dots, which reached to the vicinity of the optic disc. Near the edge of the halo there was a broken line of fine pigment, while within the circumference there were discrete hemorrhagic spots. Retinal veins of normal aspect passed over the halo of dots, without showing any modification in their course. (One illustration.) W. H. Crisp.

Rocha de Souza, Admardo. **Embolism of the central artery of the retina. Treatment with retrobulbar acetylcholine.** Rev. Brasileira de Oft., 1943, v. 1, June, pp. 219-224.

The drug was administered by retrobulbar injection, at intervals of 12 hours, and using one c.c. at each in-

jection. Enormous edema of the eyelids occurred almost immediately after the injection. But within a few hours the vision had risen from shadows to one third. Later the vision reached normal. The 1 c.c. of the drug is combined with 0.5 c.c. of a one-percent solution of novocaine. W. H. Crisp.

Von Sallman, L., Meyer, K., and Di Grandi, J. **Experimental study on penicillin treatment of ectogenous infection of vitreous.** Arch. of Ophth., 1944, v. 32, Sept., pp. 179-189.

From previous research, the authors had concluded that the present potent and less toxic antibacterial agents, such as the sulfonamide compounds and penicillin, introduced iontophoretically and supplemented by systemic treatment, did not check experimental endophthalmitis when the infection had spread from the anterior segment to the vitreous space. Failure attended attempts to increase the concentration of sulfadiazine in the vitreous by transscleral iontophoresis. Penicillin, also, did not enter the vitreous in detectable amounts with either local or systemic administration. Because of failure of the aforementioned methods to produce adequate concentrations of chemotherapeutic agents in the vitreous, direct injection of the drug into the vitreous space, hazardous as it seemed, was considered as a possible approach.

A single injection of 0.2 c.c. of a solution containing 2.5 mg. of sodium penicillin per c.c. into the vitreous of rabbits secured bacteriostatic activity of the vitreous fluid for more than 24 hours. Approximately the same concentrations of penicillin and sulfacetimide were found in the aqueous of rabbits after iontophoretic application of a solution containing both their sodium salts as after iontophoretic application of a solution containing the individual salt. Topical treatment with penicillin and sulfacetimide, supplemented by systemic administration of sulfadiazine, was not more effective than local penicillin therapy in the treatment of an experimental intraocular infection with one strain of Staph. aureus. (2 tables, References.) R. W. Danielson.

Wagener, H. **Toxoplasmic chorioretinitis.** Amer. Jour. Med. Sciences, 1944, v. 208, Aug., p. 255. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Greeves, R. A. **Retrobulbar optic neuritis: a pathognomonic sign.** The Lancet, 1944, v. 246, June 3, p. 715.

The writer calls especial attention to one symptom which does not seem to be so commonly known as the other symptoms of the early stages of acute retrobulbar optic neuritis, including the central scotoma, partial dilatation of the pupil, and sensation of pain when the eyeball is moved. The other symptom consists in a tenderness usually experienced only when pressure is applied to the upper surface of the eyeball but limited to a spot in the middle line corresponding roughly to the site of the attachment of the superior rectus tendon. The writer regards its presence as pathognomonic of retrobulbar neuritis. The textbooks merely mention that the eyeball is tender on pressure, without specifying a limited area. The symptom is present only in the early stages of the disease. Like pain on movement, it disappears in a matter of days. M. Lombardo.

Hammes, E. M. **Papilledema in optic neuritis and tumor of the brain.** Med. Clinics North America, 1944, p. 957.

The presence or absence of physiologic cupping is not a reliable criterion for differential diagnosis, for glial excess on the disc, or colloid deposits, may cover such cupping. More important in differentiating between choked disc and optic neuritis is the duration of symptoms, longer in choked disc, shorter in neuritis. Other signs discussed are headache, visual acuity, visual field, blind-spot enlargement, and X-ray evidence of tumor.

R. Grunfeld.

Scott, J. G. **Eye changes in trypanosomiasis.** Jour. Tropical Med. and Hygiene, 1944, v. 47, May, p. 15.

The author examined 150 patients infected with Trypanosoma Gambiense. Keratitis due to the disease was not common. Chorioretinitis and optic atrophy were not seen. Iridocylitis, characterized by keratic precipitates out of proportion to the mild ciliary inflammation, was present in four hospitalized cases. Bilateral optic atrophy followed tryparsamide treatment in one case. The author recommends testing the visual acuity before each tryparsamide injection. R. Grunfeld.

Tassman, I. S. **Foster Kennedy syndrome with fusiform aneurysm of internal carotid arteries.** Arch. of Ophth., 1944, v. 32, Aug., pp. 125-127.

The syndrome of Foster Kennedy has usually been considered to be indicative of a basofrontal tumor. Several cases have been reported in which the condition arose from non-neoplastic diseases involving the blood vessels. The author describes a case of this type in a woman of 32 years. Pain in the left eye was followed by progressive failure in vision of that eye. When examined nine months after onset of the illness, the vision of the right eye was 6/6 partly and that of the left eye ability to see hand movements at 12 inches. The right eye showed a definite papilledema measuring 3 diopters, with marked blurring of the margin of the disc. The left eye showed a white disc with slightly blurred margins and deep central excavation. General neurologic examination revealed no other abnormality. Encephalography showed lack of sharpness of the extreme anterior horn of the lateral ventricles. Upon craniotomy on the left side, a fusiform aneurysm of the internal carotid artery was found. It was impossible to do anything to the vascular lesion on that side. At a later right craniotomy the optic nerve was found to be pressed against the upper margin of the optic foramen. To relieve this condition the roof of the optic canal was removed for approximately a half inch. From direct surgical inspection supplemented by arteriography with diodrast, it was possible to make a diagnosis of fusiform aneurysm of both internal carotid arteries, with formation of anomalous loops in the course of the arteries and compression of the optic nerves. The vision of the right eye continued to fail, so that at the last examination it was 5/200, with extensive field constriction. (References.)

John C. Long.

12

VISUAL TRACTS AND CENTERS

Engel, G. L., and others. **A migraine-like syndrome complicating decompression sickness. . . .** War Med., 1944, v. 5, May, pp. 304-314.

The writers describe the clinical features of this syndrome, present data

relevant to its mechanism, and direct attention to the striking similarity which the syndrome bears to clinical migraine. Visual disturbances are common among subjects experiencing decompression sickness during exposure to simulated high altitudes in a decompression chamber. These are scotomas followed by headaches and other neurologic signs such as pareses, sensory disturbances, and aphasias which are also followed by headaches. The report is based on a total of 1,361 exposures to simulated altitudes of 30,000 to 38,000 feet, in 155 subjects. Seventeen subjects experienced the reaction. The symptoms occurred repeatedly in some persons and not at all in others. Visual-field studies revealed that the scotomas were homonymous and shifted rapidly in position. Headaches were always contralateral to the scotomas, began when the latter disappeared, and were sometimes associated with nausea and vomiting. Electroencephalograms taken during this reaction revealed abnormalities in the cortex corresponding to the focal neurologic signs. Evidence is presented that this reaction is mediated through a vascular mechanism. (2 case reports, 4 charts.)

M. Lombardo.

13

EYEBALL AND ORBIT

Gonçalves, Paiva. **Comments on a case of pulsating exophthalmos.** Rev. Brasileira de Oft., 1943, v. 1, June, pp. 179-191.

The patient, a young Negro, attempted suicide by firing a revolver into the right ear. Some time later he underwent a lengthy operation for extraction of fragments of the petrous portion of the right temporal bone, as well as the bullet. Four months later the eye on the same side protruded and was congested; and a week later there was neuroparalytic keratitis and an angioneurotic edema. The eye turned inward. The visual acuity varied from nothing to one-sixth. In the course of two weeks the exophthalmos on the right side amounted to 28 mm., and the left eye developed exophthalmos of 14 mm., increasing to 24 mm. The author believes that the exophthalmos was not an indirect result of the operative interference, but arose from traumatism produced by the revolver shot. Ultimately the symptoms, which also included a bruit, were relieved by tying the internal carotid. (One photograph.)

W. H. Crisp.

Goodhill, V. **Penicillin treatment of cavernous sinus thrombosis.** Jour. Amer. Med. Assoc., 1944, v. 125, May 6, p. 28.

In a child five years of age bilateral cavernous sinus thrombophlebitis was cured by administration of penicillin intravenously. Improvement was noted within twelve hours after institution of the treatment. Preliminary treatment with heparin and sulfathiazole had been of no avail. (3 figures.)

Robert N. Shaffer.

Kolen, A. A. **A knife hook for section of the recti muscles in enucleation.** Viestnik Oft., 1943, v. 22, pt. 3, p. 18.

The author sharpens the inner edge of a strabismus hook, which after being introduced under the muscle shaves it off from the sclera. He claims that its use dispenses with the need for an assistant in doing an enucleation.

Ray K. Daily.

Krause, A. C., and Rosenberg, W. **Treatment of metastatic meningococ-**

cic endophthalmitis. Arch. of Ophth., 1944, v. 32, Aug., pp. 109-112.

A girl of 18 years, with meningococcic meningitis, was admitted to the hospital on the fourth day of illness. Both corneas were cloudy and the eyes were red. Treatment consisting of administration of antimeningococcic serum and of sulfadiazine resulted in recovery from the meningitis. On the twenty-third day of the illness both eyes showed serious damage from endophthalmitis, with vision reduced to perception of hand movements at three feet. The scleras were very red. The corneas and anterior chambers were extremely hazy and the pupils were irregularly dilated and adherent to the lenses. A yellow exudate behind each lens made the details of the fundi invisible. Sulfadiazine orally and atropine sulphate locally were applied. Penicillin was administered by iontophoresis for approximately a month. Typhoid vaccine was used intravenously on two occasions.

Within three months of the onset of the disease the vision of the right eye had improved to approximately 20/30. The left retained only perception of hand movements. The right eye appeared essentially normal except for posterior synechiae and vitreous haze. The left eye was slightly softer than the right and contained a dense white mass in the pupillary space. The authors consider that sulfadiazine and penicillin were the deciding factors in the improvement in this case. A remarkable feature was that the disease had been present for 24 days without remission before improvement occurred. (References.)

John C. Long.

Sloane, H. O. **Orbital cellulitis treated successfully with penicillin.** Jour. Amer. Med. Assoc., 1944, v. 126, Sept., pp. 164-166.

Under the continued intravenous use of penicillin for ten days, orbital cellulitis of the left eye in a boy of 12 years cleared up completely, so that surgery upon the infected left ethmoid and maxillary antrum was unnecessary. Sulfadiazine in fairly large doses was tried without effect, and was discontinued when penicillin was begun. (2 figures.) Robert N. Shaffer.

14

EYELIDS AND LACRIMAL APPARATUS

Maggi Zavalia, J., Zurbriggen, M. B., and Russo, O. **Ophthalmoplegic form of myasthenia gravis.** Anales Argentinos de Oft., 1943, v. 4, Oct.-Nov.-Dec., pp. 143-151.

The authors consider this condition more than simply interesting, since cases of ophthalmoplegia have developed into florid myasthenias, and since, too, pharmacologic proof of an existing myasthenia can be established.

Two cases are presented. In a three-year-old male the initial symptom was sudden ptosis of the right upper lid which worsened toward the end of each day, but showed periods of remission and relapse. Complete laboratory examination yielded no abnormal findings. Temporary recovery was achieved with intramuscular prostigmine solution. An eight-year-old female showed bilateral ptosis of the upper lid, also accentuated at the end of the day. It responded to intramuscular prostigmine solution. Thus prostigmine affords pharmacologic corroboration of a suspected myasthenia gravis.

This latter disease may occur as an ophthalmoplegia, as above described, or as an amyotrophy, or in association with other syndromes. The ophthalmo-

plegic form is the most readily studied. The prognosis depends on the type of myasthenia, the ophthalmoplegic type being compatible with long life. The etiology is obscure. (2 illustrations, references.) Edward Saskin.

Morgenstern, D. J. **Intranasal drainage for cure of chronic infection of the tear sac.** Arch. of Ophth., 1944, v. 32, Aug., pp. 101-103.

The author describes his technique for producing a fistula between the tear sac and the nasal cavity. A thin knife, insulated except at the tip, is passed through the dilated canaliculus into the sac and the medial wall of the sac is then incised. An inverted-U-shaped incision is made under the guidance of the palpating forefinger placed over the sac. To assure complete continuity of the U-shaped incision, the electrocoagulating current is applied to the knife. A probe is then passed through the lower canaliculus into the bottom of the tear sac and is pushed into the nasal cavity at an angle of about 45 degrees. Using this probe as a guide, the bony lacrimal fossa is broken down as widely as possible with wire hooks. Irrigation with copious amounts of fluid then turns the U-shaped flap of the sac wall down into the newly formed bony opening into the nose. Finally electrocoagulation of the newly formed opening is carried out through the nose. This method has been found satisfactory even in shrunken and sclerotic sacs. As there is a minimum of tissue destruction and usually scarcely any bleeding, the procedure can be carried out in the office. (References.) John C. Long.

Mutch, J. R. **The lacrimation reflex.** Brit. Jour. Ophth., 1944, v. 28, July, 317-336.

The pathways and connections of the nerves and ganglia required for proper functioning of the lacrimation reflexes are described with diagrams. Clinical observations here reported show that the sensory or afferent pathway for reflex lacrimation is the ophthalmic division of the fifth nerve, and that the efferent pathway runs in the seventh nerve but is independent of the motor fibers of the face muscles and lies separate from the seventh nerve in the brain near the sixth nucleus and also peripheral to the geniculate ganglion. Motor impulses are shown to pass along the greater superficial petrosal nerve.

Psychic weeping is bilateral and cannot be inhibited by surface anesthesia of the conjunctiva or cornea, or by paralysis of the fifth nerve or section of the cervical sympathetic. The cervical sympathetic takes no part in reflex or psychic lacrimation. (6 figures, references.)

Edna M. Reynolds.

Reese, A. B. **Partial resection of the lid and plastic repair for epithelioma and other lesions involving the margin of the lid.** Arch. of Ophth., 1944, v. 32, Sept., pp. 173-178.

With a series of excellent photographs and drawings, the author describes various types of operation involving halving of the lids or canthotomy with sliding of a cutaneous flap. (One reference.)

R. W. Danielson.

Silvers, S. H. **Microsporon audouini infection of the eyelashes.** Arch. Derm. and Syph., 1944, v. 49, June, p. 436.

The author records the case of a white boy, 8½ years old, who had a ringworm infection of the right cheek

of about two weeks duration. Hairs of the cheek, and later some eyelashes, fluoresced under the Wood filter. Infected hairs, when removed and cultured, showed Microsporon audouini. At a late stage the right upper and lower lids became swollen and the conjunctiva inflamed, and under the Wood filter about one-half of the upper lashes and one third of the lower showed fluorescence. The treatment consisted of manual epilation of the infected lashes. Later examinations under the Wood filter, the first two held at weekly intervals and the last one after a month's interval, failed to show infected lashes.

Theodore M. Shapira.

Whalman, H. F. **Reconstruction of ablated lower lid.** Arch. of Ophth., 1944, v. 32, July, pp. 66-67.

The method here described arose out of the necessity for extensive ablation of the lower lid in a case of basal-cell carcinoma which had grown in both directions laterally from the middle of the lower lid and had invaded the tarsal cartilage. The growth was invasive and did not subside under moderate irradiation. Since a larger dose would have resulted in destruction of the lid, excision, with a safe margin, seemed advisable. The author describes his method of transplanting a part of the upper lid to fill in the defect in the lower lid. Excellent drawings supplement the description.

R. W. Danielson.

15

TUMORS

Asbury, M. K. **Epithelial tumors of the iris.** Amer. Jour. Ophth., 1944, v. 27, Oct., pp. 1094-1106; also Trans. Amer. Ophth. Soc., 1943, v. 41, p. 368. (9 illustrations, bibliography.)

Rosen, Emanuel. **Bilateral teratoid tumor of the limbus.** Arch. of Ophth., 1944, v. 32, Aug., pp. 120-122.

A man aged 25 years had noticed poor vision of the right eye and a peculiar appearance of both eyes as long as he could remember. The condition of the eyes had not undergone any appreciable change. The right eye showed a peculiar dusky injection of the bulbar conjunctiva and three hypervascularized masses. These masses were grayish, slightly elevated, and sharply outlined. They covered approximately 2 mm. of the cornea and extended into the cul-de-sac. The cornea was irregularly staphylomatous, the vision 5/200. The left eye showed two smaller and less vascularized masses similar to those observed in the right eye. The vision of the left eye wa 20/20.

One of the masses, measuring 6 by 5 by 5 mm., was removed from the right eye. Microscopically the sections showed many loose adipose structures in which were many islands of lacrimal gland. Several areas of adipose tissue were intermixed with loose connective tissue. Three areas of cartilaginous tissue surrounded by a richly nuclear perichondrium were observed. An occasional bundle of nerve fibers was present. The description of several teratomatous tumors is quoted from the literature, as well as theories of causation. (One drawing, one photomicrograph.) John C. Long.

Rosen, Emanuel. **Nevus flammeus associated with conjunctival telangiectasia and possible early choroidal tumor.** Amer. Jour. Ophth., 1944, v. 27, Oct., pp. 1143-1145. (4 figures.)

16

INJURIES

Brodsky, B. S. **Hand magnet for removal of splinters from the eye, and some observations relative to magnet operations.** Viestnik Oft., 1943, v. 22, pt. 3, p. 13.

The author advocates the use of the Soviet-manufactured hand magnet in the extraction of intraocular foreign bodies. He claims that it is effective in extracting foreign bodies from the anterior ocular segment through an open anterior chamber, and is successful in diascleral extraction provided localization of the foreign body is accurate. This hand magnet is portable and independent of the electric current.

Ray K. Daily.

Brown, A. L., and Nantz, F. A. **Corneal healing: adhesive power of aqueous fibrin in the rabbit.** Amer. Jour. Ophth., 1944, v. 27, Nov., pp. 1220-1224. (One figure, 2 tables, references.)

Campos, Evaldo. **Cataract from industrial electricity.** Rev. Brasileira de Oft., 1944, v. 3, Sept., pp. 31-36.

A white workman aged 61 years, handling a 15,750-volt, 22-ampere transformer for conversion from a current of 220 into 110 volts, received a large electrical discharge and fell unconscious. He was found with the wire in contact with his forehead and with the left wrist adherent to the key of the transformer. He made almost complete recovery, except that he became progressively completely blind (time not stated). Each eye had total cataract, of a mother-of-pearl appearance, but with good light perception and projection. (2 figures.) W. H. Crisp.

Ershkovich, I. G. **Therapy with transplantation of preserved tissues preliminary to surgical procedures in war injuries.** Viestnik Oft., 1943, v. 22, pt. 3, p. 19.

With a report of cases the author demonstrates the beneficial effect on traumatic iridocyclitis of transplantation of small segments of preserved placenta into the skin of the mastoid. In one case the procedure arrested the development of a secondary glaucoma, and the eye tolerated a subsequent iridectomy which normalized the intraocular tension and improved visual acuity to .03. In another case of traumatic iridocyclitis, with iris bombé and occlusion of the pupil, the effect of the preserved placenta was to save the eye from enucleation. The author credits this form of therapy with the favorable course of iridectomies and lens extractions following severe traumatic iridocyclitis. Poor light projection becoming normal after transplantation served as indication for iridectomy or cataract extraction which resulted in further improvement in visual acuity.

Ray K. Daily.

Karandasheva, K. M. **Perforating ocular injuries in the material of the N Hospital.** Viestnik Oft., 1943, v. 22, pt. 3, p. 24.

In this special army hospital perforating injuries occurred in 41 percent of the cases, 96 percent of them being caused by fragments of mines, bombs, or grenades and 4 percent by bullets. In 17 percent of the cases both eyes were injured. In 40 percent there was total loss of vision in one eye. In 37 percent foreign bodies were found within the eye and 16 percent in the orbit. No hair or wool particles were found with the foreign bodies, even at enucleation. The lids were injured in 35 percent of the cases, the cornea in 11.5 percent, the conjunctiva in 5.5

percent, the sclera in 13.5 percent, and the eyeball was completely destroyed in 35 percent. Perforating scleral injuries were found in 35 percent of the cases. Ophthalmoscopy was possible in 27 percent of the cases. The average hospitalization time was 9 to 11 days. Eye injuries should be seen by an ophthalmologist within the first one or two days. Results were better in the injured who reached the hospital within the first 24 to 36 hours. Soldiers with eye and orbital injuries should be evacuated in the recumbent position. Ray K. Daily.

Katznelson, A. B. **Remarks on conjunctival plastic procedures in war injuries of the cornea.** Viestnik Oft., 1943, v. 22, pt. 3, p. 11.

The author disparages the use of the Kuhnt conjunctival flap in corneal injuries, preferring corneal sutures, which in his experience result in more accurately coapted edges, and better protection of the uvea. The conjunctival flap is suitable for extensive scleral and corneoscleral wounds with prolapse of uveal tissue. Gaping scleral wounds should be sutured. Ray K. Daily.

Krasnov, M. L. **Clinical evaluation of hand magnets made of iron, nickel, and aluminum alloy.** Viestnik Oft., 1943, v. 22, pt. 3, p. 15.

On the basis of experience in one hundred cases, the author concludes that the nonelectric hand-magnet is inadequate for magnet extraction of intraocular foreign bodies, and is inferior to the electromagnet. He believes that a giant magnet is an essential equipment of an ophthalmologist attempting magnet extraction. Ray K. Daily.

Krol, A. G. **A case of traumatic retinal angiopathy with recovery, following compression of the chest.** Viestnik Oft., 1943, v. 22, pt. 3, p. 27.

During explosion of an aërial bomb, a soldier suffered a blow on the chest and arm and a fracture of the left clavicle. He remained unconscious for a day. Three days after the injury he noticed impairment of vision. The eyes were examined 17 days later. In the left fundus were several edematous areas with small hemorrhages, similar to the type described by Purtscher in skull injuries. The eye recovered. The author suggests that ocular examination be made in all cases of chest injury. Ray K. Daily.

Lijó Pavía, J. **Blood disc of the cornea.** Rev. Oto-Neuro-Oft., 1944, v. 19, March-April, pp. 41-52.

Blood staining is an infrequent complication of contused and penetrating wounds of the cornea. It was first reported in the literature in 1509. The author reports the case history of an 8-year-old girl who received a severe direct blow to her left eye resulting in "hemophthalmos." After absorption of the blood a hematic disc was observed in the center of the cornea, extending beyond the pupillary space. The disc was reddish with a dark border. Biomicroscopic study and color photography placed the disc in Descemet's membrane and the parenchyma. Diminution in size and density of this opacity was achieved by phototherapy, using red-free light.

In his discussion the author differentiates between corneal contusion and luxation of the lens into the anterior chamber, the former being associated with corneal hyposensitivity, oscillating intraocular tension, and blood-staining of the cornea. The blood stain usually lasts months or even years. Edward Saskin.

Ochapovskaja, D. **Hemotherapy in burns of the eyes and keratitis.** Viestnik Oft., 1943, v. 22, pt. 3, p. 45.

Ochapovskaja is very enthusiastic about her method of therapy, the principal feature of which is the frequent instillation into the conjunctival sac of the patient's defibrinated blood; the cornea is thus nourished by plasma, and is provided with oxygen by the erythrocytes. In addition the blood exerts a favorable action by its content of numerous immune bodies and ferments, and it restores the normal p_H disturbed by the burn. Immediately after the burn the eyeball is irrigated profusely to eliminate whatever of the offending chemical is left, and necrotic tissue is curetted away. Hemotherapy is instituted immediately, and fine adhesions between the eyeball and the lids are separated twice daily to prevent synechia. Under this régime the corneal epithelium regenerates in from two to six days. Ray K. Daily.

Pendergast, J. J. **Routine eye-treatment technique.** Industrial Medicine, 1944, v. 13, Aug., p. 604.

The author describes the standard ophthalmic procedure developed in the various plants of the Chrysler Corporation. Great care is taken for sterile action. Not only do nurses remove superficial foreign bodies with a tooth-pick applicator but as a war-time measure they remove embedded foreign bodies with a spud. Acid and alkali burns are to be washed with a copious amount of saline solution. If the cornea stains with fluorescein the patient must be seen by an oculist. Flash burns are treated with pontocaine and adrenalin.
R. Grunfeld.

Rabinowicz, W. G. **Military plastic surgery in ophthalmology.** Viestnik Ophth., 1943, v. 22, pt. 3, p. 3.

The variety of injuries about the orbit requires a versatility and individualization in surgery needed in no other region. The qualifications of an ophthalmologist doing plastic surgery are initiative, imagination, creativeness, ability to deviate from a previously prepared plan, and improvisation. He should be thoroughly acquainted with the anatomy and physiology of his surgical field. He should have a meticulously prepared plan of operative procedure, and he should be able to visualize the desired surgical result. He should choose the simplest procedure which will attain the desired objective within the shortest possible time, and which will insure restoration of anatomic form and function; and which, in case of failure, will not make further operative interference difficult by excessive destruction of tissue. He should possess a sense of form and be somewhat of an artist.

The author uses pedicle flaps and free transplants. The plastic procedures used are principally those of Imre. (Illustrations.) Ray K. Daily.

Sherman, A. R. **The application of Guist's localizing instrument in the extraction of intraocular foreign bodies by the posterior route.** Amer. Jour. Ophth., 1944, v. 27, Oct., p. 1149. (1 figure.)

Siegel, Ralph. **Búccal mucous membrane grafts in treatment of burns of the eye.** Arch. of Ophth., 1944, v. 32, Aug., pp. 104-108.

The treatment of severe chemical burns in eight patients is described. Seven of the patients were Negroes. In the order of their severity, the agents causing the burns in this series of cases were lye, gasoline, sulphuric acid, and lime. Five of the patients were treated

by prompt mucous-membrane grafts to the bulbar conjunctiva. The end results illustrate the value of the grafting. The author states that grafting should be performed in cases of burns of the eye of the following types: (1) direct burn of the cornea with a perilimbal circulation; (2) direct burn of the cornea with a perilimbal circulation of questionable integrity; (3) burn of the bulb with local destruction of the perilimbal circulation but unaccompanied by corneal involvement.

Immediate grafting stimulates vascularization, which helps restore corneal nutrition, with early return of functional power. This procedure also prevents the formation of scar tissue with symblepharon. If grafting is done too late or is omitted, local anoxemia leads to infiltration of the cornea, with leukoma and other sequelae. A porcelain-white sclera after a burn offers a grave prognosis unless grafting is promptly done. Even so, the damage may be so great that the eye goes on to corneal perforation. Except in those cases where the perilimbal circulation is totally destroyed, early grafting not only shortens the course of the healing process but offers a better prognosis. The technique of the operative procedure is given. (8 color photographs, references.) John C. Long.

Smelser, G. K., and Ozanics, V. **Effect of chemotherapeutic agents on cell division and healing of corneal burns and abrasions in the rat.** Amer. Jour. Ophth., 1944, v. 27, Oct., pp. 1063-1072. (6 figures, references.)

Sobol, I. M. **War injuries of the nasal sinuses and their treatment.** Viestnik Oft., 1943, v. 22, pt. 3, p. 28.

Injuries of the nasal sinuses are frequent and may be accompanied by various ocular complications. Constriction in the visual field or a disturbance in color vision may be overlooked. More frequently, there is edema about the orbit accompanied by displacement of the eyeball forward or forward and outward, rapid loss of vision, headache, and septic temperature. The diagnosis of involvement of the sphenoid sinuses is difficult even with detailed roentgenographic study. The author's material shows that frequently the dominating clinical factor is not the trauma to the sphenoid sinuses but the character and extent of the secondary inflammatory phenomena, and it is these symptoms which determine the type of treatment. In firearm injuries of face and orbit the possibility of injury to the sinuses should be kept in mind, and roentgenograms taken in several positions are obligatory. Treatment has to be individualized, depending on the symptoms. Only fundus changes, extension of inflammatory phenomena in the soft orbital tissues, and meningeal symptoms should be considered indications for early operative interference.

Ray K. Daily.

Spaeth, E. B. **Removal of metallic foreign bodies from the eyeball and from the orbit.** Proc. Interstate Postgrad. Med. Assoc. North America, 1943, p. 52.

The eye must have retained some degree of vision if one is to attempt to remove an intraocular foreign body. The iris and the ciliary body must not be too severely damaged. When in doubt it is a wise rule to enucleate. X-ray localization is discussed, including in borderline cases the injection of air into Tenon's capsule to decide whether the foreign body is intraocular. The author discusses the choice of cases for giant magnet and hand

magnet respectively; and extraction behind the equator, with avoidance of vortex veins and followed by scleral suture. In cases of nonmagnetic foreign body, radiopaque landmarks permit flap sclerotomy and extraction. When the vitreous is clear the endoscope and specially shaped forceps for grasping the foreign body may be resorted to. In other cases the biplane fluoroscope technique has to be used.

R. Grunfeld.

Trevor-Roper, P. D. **The late results of removal of intraocular foreign bodies with the magnet.** Brit. Jour. Ophth., 1944, v. 28, July, pp. 361-365.

A review of 154 cases in which a magnetic foreign body was successfully removed from the eye is given. The cases were treated at Moorfields Hospital during the first four years of the war. In only two cases was the posterior route used. One eye became shrunken and sclerotic and the other required enucleation. Removal through the scleral wound of entry was done in two cases. In both of these vision was reduced, one from a localized cataract and the other from macular striae. In the remaining 150 cases, the anterior route was employed.

Two thirds of the cases without lens injury retained good vision. The lens was injured in two thirds of the cases, but in 14 percent of these the cataract was localized enough to allow reading vision. Delay in removing the foreign body was shown to be of little consequence. Corneal wounds had a better prognosis than limbal or scleral wounds in the ciliary region. Cases without uveal damage showed a much smaller reduction of vision than cases complicated by iris or ciliary prolapse.

The strengths of the magnetic fields from various magnet tips have been estimated and are given in tabular form.

Edna M. Reynolds.

Tumarkina, M. **Late result of a severe ocular injury.** Viestnik Oft., 1943, v. 22, pt. 3, p. 46.

A student had his only eye injured by a powder explosion. When he arrived at the Helmholtz Hospital three weeks later, there was powder embedded in his lids, cornea, and conjunctiva. There was an opacity in the lens, and the vitreous was cloudy. Light projection was defective. Repeated examinations revealed dense vitreous opacities, which in places appeared as yellow membranes. The patient was deeply disturbed emotionally by the prospect of blindness, and after a month in the hospital he left with good light projection except nasally, where it was doubtful. His family was given a poor prognosis. The patient, however, began to improve, and within three years his visual acuity rose to 0.5, as the vitreous became clearer. As the fundus became visible a large yellowish-white focus surrounded by pigment was seen in the upper inner periphery; from this focus fine membranes extended into the vitreous. Such a recovery in an apparently hopeless case, while very rare, should nevertheless make us cautious in giving a poor prognosis even in grave cases.

Ray K. Daily.

17

SYSTEMIC DISEASES AND PARASITES

Maggi Zavalia, J., Zurbriggen, M. B., and Russo, O. **Ophthalmoplegic form of myasthenia gravis.** Anales Argentinos de Oft., 1943, v. 4, Oct.-Nov.-Dec., pp. 143-151. (See Section 14, Eyelids and lacrimal apparatus.)

Pacheco-Luna, R. **Guatemalan onchocercosis.** Ophth. Ibero Amer., 1944, v. 5, no. 4, pp. 345-347 (in Portuguese); pp. 347-350 (in English).

The disease, discovered in Guatemala in 1915 by Robles, is endemic in the rich coffee-bearing zones of the Western slope of the Guatemalan Andes, and in neighboring parts of Mexico. The filaria lives inside of fibrous tumors, which may reach the size of a dove's egg. The microfilarias emigrate outside the tumors.

Transmission of the organism is effected by means of flies of the genus Simulides. The number of persons attacked in Guatemala is estimated at 20,000, 2 percent of the inhabitants of the endemic zones being blind. The onset of ocular invasion is announced by intense photophobia, blepharospasm, and a sense of foreign body. There is no medicinal specific. Simple extirpation of the tumors is the principal treatment, but it has no effect on the microfilarias, which continue to live for an appreciable length of time.

W. H. Crisp.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Awerbach, M. I. **The first twenty-five years of Soviet ophthalmology.** Viestnik Oft., 1942, v. 21, pt. 6, p. 3.

In this article the dean of Russian ophthalmologists reviews the advances in ophthalmology during the last 25 years, and the contributions of Russian ophthalmologists. Outstanding is the development of synthetic substitutes for cocaine, which practically eliminated general anesthesia in ophthalmic surgery in adults. Corneal transplantation has become effective and feasible since the utilization of preserved cadaver cornea was introduced by Filatov. The six thousand dacryocystorhinostomies performed at the Helmholtz Institute demonstrate that there are no contraindications to this operation. Extirpation of the lacrimal sac leaves a soldier disabled for service, while dacryocystorhinostomy permits him to return to active duty. Present investigations are concentrated in the field of plastic surgery on the lids and adjacent structures. The war did not interrupt the program of Soviet ophthalmology, but it directed research into the field of prophylaxis and treatment of war injuries. Ray K. Daily.

Crisp, W. H. **Pitfalls of the general physician in ocular diagnosis.** Rocky Mountain Med. Jour., 1944, v. 41, Sept., pp. 626-633.

The author decries the attitude of some general practitioners who believe that they should not or could not learn more about the eye than they already know, and the attitude of others who keep too long a case which ought to be sent to an ophthalmologist. Every physician should know something about the anatomy and physiology of the eye, and about the principles of refraction. He should be familiar with simple methods of eye examination, for instance oblique illumination and taking tension with the fingers; and also with the use of the ophthalmoscope. He should be able to differentiate a normal from a pathologic fundus picture, and between iritis and glaucoma. He should know that marked optical defects may cause cross eye, and that this may be commonly overcome in earlier life by corrective lenses. The general physician can get this information by careful

reading and by diligent attendance at an eye clinic. R. Grunfeld.

Gradle, H. S. **The Pan-American Congress of Ophthalmology.** Ophth. Ibero Amer., 1944, v. 5, no. 4, pp. 350-364.

This, translated into Portuguese, is the material which was published in English in the Transactions of the American Academy of Ophthalmology and Otolaryngology, 1943, October, p. 35.

Pérez Porcel, Enrique. **Trachoma in Bolivia.** Arch. de Oft. de Buenos Aires, 1942, v. 17, Oct., p. 605.

Bolivia is fortunate in having no trachoma problem. The rare cases observed are found in immigrants, and the native population is free from this scourge, in spite of the poverty, ignorance of elementary hygienic practices, and undernourishment of the lower classes. Analyzing the factors which make the country trachoma-free, the author discusses, among others, the following: small foreign immigration in comparison with the countries on the seaboard; inland geographic situation, with reduced population and few means of communication; population centers situated at an altitude of over 2,500 meters above sea level, with the unquestionably beneficial influence of climatic conditions. (References.)

Plinio Montalván.

Post, L. T., and Slaughter, H. C. **National ophthalmological societies in the United States.** Amer. Jour. Ophth., 1944, v. 27, Nov., pp. 1225-1228.

Savvaitov, A. C. **Ophthalmic services during the last twenty-five years.** Viestnik Ophth., 1942, v. 21, pt. 6, p. 17.

Before the Soviet Revolution, Russia headed the list of European countries in the percentage of blindness. It had about three hundred ophthalmologists living mostly in large cities, and a total of two thousand ophthalmic beds. It had no public-health service. In 1918 the newly organized Public Health Service prepared a program of care and prophylaxis. In 1920 the ophthalmic division of the Public Health Service developed its program. As a result the number of ophthalmic beds today exceeds eight thousand, and the number of ophthalmologists exceeds two thousand. The number of graduate ophthalmic clinics increased from 11 to 35. Eleven trachoma dispensaries were opened, and almost eight thousand rural clinics and thirty-five hundred trachoma stations were established. Six eye institutes and six trachoma institutes were built, and large ophthalmic sections were opened in all large hospitals. The Helmholtz Institute in Moscow is pursuing research in retinal detachment, diascleral extraction of foreign bodies, and dacryocystorhinostomy. The Institute of Experimental Ophthalmology was devoted chiefly to corneal transplantation. The Ukraine Institute is investigating color vision and glaucoma, and the construction of ophthalmic apparatus. The prophylactic section issued numbers of leaflets, placards, exhibitions, and films for use in schools and industries and on farms. As a result the incidence of trachoma fell significantly. Ophthalmia neonatorum diminished, and blindness from smallpox was eliminated. Syphilis of the eyes is becoming rare, and complications of infectious diseases of childhood are becoming fewer. When Russia was attacked by Germany in 1941, the ophthalmic efforts were diverted

toward organization of an efficient ophthalmic service at all points of military evacuation, provision of services for evacuated civil populations, and the management of epidemics, particularly among children deprived of vitamins through confiscation of all dairy products by the Germans. Ray K. Daily.

Savvaitov, A. C. **The struggle against trachoma for the last twenty-five years.** Viestnik Oft., 1942, v. 21, pt. 6, p. 22.

In Czarist Russia trachoma was very prevalent, especially among the rural population and particularly among foreigners, who were treated as colonials and had no provision for education, culture, sanitation, or medical services. The enfranchisement of foreigners, as well as of women, came with the Social Revolution. During the first years after the Revolution all medical services were attached to the Red Army. In 1922 the Trachoma Institute was opened at Kazan, as a part of the program in the struggle with trachoma. This struggle was carried on through a network of trachoma stations reaching into all trachoma areas, and through the training of specialized personnel. The program was interrupted by the war, but is to be resumed at its conclusion. Ray K. Daily.

Senâ, J. A. **Evaluation of workmen's disability from partial loss of vision of one eye.** Arch. de Oft. de Buenos Aires, 1942, v. 17, Nov., p. 697.

The evaluation of disability from partial loss of vision of one eye must be proportionate to the visual loss sustained. The notations for visual acuity do not constitute fractions of vision. Applying to the Argentine workmen's compensation laws the percentages of visual efficiency derived from the experimental, clinical, and mathematic researches of Snell and Sterling, approved by the American Medical Association, values are obtained which correspond very closely to those arrived at by the author to determine the disability from partial loss of vision of one eye when the other eye is normal. (Tables.) Plinio Montalván.

Sorsby, Arnold. **Trachoma in London: the end of a chapter.** Brit. Med. Jour., 1944, Aug. 12, p. 220.

In May, 1944, the last five remaining children in the trachoma block at White Oak Hospital were discharged and the block closed down. Formerly, poor hygienic conditions and rudimentary medical facilities made trachoma and other infections endemic in Poor Law institutions. The need for effective isolation and treatment was pressed upon the authorities, with the result that two ophthalmic hospital-schools were erected. The other hospital school became superfluous in 1918. The numbers of admissions to the White Oak Hospital were as follows: In 1903, 292; between 1904 and 1913, a yearly average of 112; during the next decade, 29; the following decade, 34; and in the last decade an average of 13 yearly admissions.

Trachoma is still not infrequent in London and remains a potential source of epidemic. Early and persistent treatment is essential. As indicative of what can be achieved by systematized and persistent effort the experience at Glasgow is quoted. Notification is compulsory. Systematic treatment in the trachoma clinic and examination of contacts are carried out, and provision is made for hospitalization of adults and children who need it. The number of

new cases in Glasgow in 1915 was 112; in 1925, 41; in 1935, 18; and in 1943, 3.

R. Grunfeld.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Haden, H. C. **Concerning the relations of the developing optic nerve to the recessus opticus and the hypophysis in young fetuses: a study of seven human fetuses 4 mm. to 40 mm. inclusive.** Amer. Jour. Ophth., 1944, v. 27, Oct., part 2, pp. 1-44. (41 illustrations, references.)

Semeraro, Edmundo. **Contribution to anatomic study of the eyeball.** Rev. Brasileira de Oft., 1943, v. 1, June, pp. 209-212.

The author describes the variations which he has encountered post mortem, in the structure of Tenon's capsule. Sometimes there are strong adhesions of the capsule to the fatty tissue and the ocular muscles. Sometimes such adhesions are absent. Sometimes Tenon's capsule seems to have undergone complete atrophy and disappearance. Some brief comments are offered as to the effect of these variations on surgical principle. (2 illustrations.)

W. H. Crisp.

Van Harreveld, A. **Oxygen consumption of degenerated optic nerves.** Proc. Soc. Exper. Biol. and Med., 1944, v. 56, June, p. 192.

The author takes issue with a report of increase in oxygen consumption of degenerated human optic nerves (Michail and Benetato, Soc. Biol.; Paris, 1936, v. 121, p. 267.)

To support his contention the author severed the optic nerves of one eye in each of six cats, and six months later removed the nerves and compared the oxygen consumption. In two cases the degenerated nerve had slightly higher metabolism, in the other four it was lower, the average favoring the normal nerves. It is suggested that the previous observations may have been in error because the nerves were minced, thereby reducing their oxygen utilization.

Benjamin Milder.

Vidal, F., and Malbrán, J. L. **Arrangement of the myelin fibers in the chiasm of the cat.** Arch. de Oft. de Buenos Aires, 1942, v. 17, Nov., p. 684.

Of a series of 20 cats, one or both eyes were enucleated in some and retinal microlesions were produced in others. The cats were allowed to live from nine days to ten months. The chiasms were studied following cresyl-violet, Weil, and Marchi techniques. From this experimental work it can be stated that in the cat no retinal fiber ends in the hypothalamus. The number of crossed fibers in the chiasm is larger than of uncrossed; the former occupy the rostral portion of this structure and the external border of its posterior half, while the latter run along the lateral borders of the anterior half of the chiasm and the ventral portion of the posterior half, where they mingle with the crossed fibers. The septohypothalamic fibers are found in the rostral and dorsal portions of the chiasm. The fibers of the ventral supraoptic commissure or commissure of Gudden invade the posterior third of the chiasm, forming its posterior border. The fibers of the ventral geniculate body are situated in the caudal and ventral portions of the commissure of Gudden. The fibers of the supraoptic dorsal commissure or commissure of Meynert

occupy the rostral portion of the medial hypothalamus and the fibers of the supraoptic dorsal commissure or commissure of Ganser are situated in the dorsal part of the medial hypothalamus. (Photomicrographs, references.) Plinio Montalván.

Vidal, F., and Malbrán, J. L. **Arrangement of the superior homolateral optic fibers in the cat.** Arch. de Oft. de Buenos Aires, 1942, v. 17, Oct., p. 626.

In this experimental work the authors employ the same technical procedure described in a previous paper (Amer. Jour. Ophth., 1944, v. 27, p. 1058) concerning the inferior peripheral homolateral fibers in the cat, producing first a retinal microlesion and studying the direction and extent of the ensuing degenerative changes throughout the primary optic tract. From the present work they show that the superior homolateral fibers have a superior or dorsal arrangement in relation to the inferior peripheral homolateral fibers. They also prove that the fibers first run on the external aspect of the tract, taking a medial position when they reach the dorsal geniculate body. (Photomicrographs.)

Plinio Montalván.

NEWS ITEMS

Edited by Dr. Donald J. Lyle
904 Carew Tower, Cincinnati 2

News items should reach the editor by the twelfth of the month.

Deaths

Dr. Joseph T. Auwers, Grand Rapids, Michigan, died September 12, 1944, aged 59 years.

Mr. William Bausch, Bausch and Lomb Optical Company, Rochester, New York, died October 19, 1944, aged 83 years.

Dr. J. A. Biever, Mount Joy, Pennsylvania, died August 27, 1944, aged 86 years.

Dr. Howard Black, Palo Alto, California, died September 21, 1944, aged 70 years.

Dr. William K. Campbell, Long Branch, New Jersey, died September 21, 1944, aged 65 years.

Dr. Charles H. Crain, Evanston, Illinois, died September 29, 1944, aged 89 years.

Dr. Richard S. Crichlow, New Orleans, Louisiana, died September 18, 1944, aged 62 years.

Dr. William E. Joiner, Seattle, Washington, died August 7, 1944, aged 74 years.

Dr. Robert H. Kistler, Lansford, Pennsylvania, died October 4, 1944, aged 55 years.

Dr. Arnaud J. LaPierre, Norwich, Connecticut, died July 12, 1944, aged 59 years.

Dr. Archibald C. Lewis, Memphis, Tennessee, died September 18, 1944, aged 67 years.

Dr. Daniel J. Maloney, Waterbury, Connecticut, died August 4, 1944, aged 77 years.

Dr. Benjamin F. Matheny, Parsons, West Virginia, died September 8, 1944, aged 65 years.

Dr. Hugh S. McKeown, New York, New York, died September 14, 1944, aged 49 years.

Dr. Elmer E. Owen, Batavia, New York, died August 2, 1944, aged 62 years.

Dr. Joseph W. Robinson, Lisbon, Ohio, died September 21, 1944, aged 50 years.

Dr. Charles M. Rosenthal, Brooklyn, New York, died September 1, 1944, aged 35 years.

Dr. Olaf H. Rystad, Grand Forks, North Dakota, died August 16, 1944, aged 68 years.

Dr. Frederick A. Smith, Troy, New York, died August 7, 1944, aged 76 years.

Dr. Henry D. Smith, Sanford, Florida, died August 12, 1944, aged 54 years.

Dr. Louie L. Steiner, Danville, Illinois, died August 17, 1944, aged 65 years.

Dr. Harry J. Stewart, San Diego, California, died October 31, 1944, aged 76 years.

Dr. James Thorington, Philadelphia, Pennsylvania, died October 27, 1944, aged 86 years.

Dr. William F. Waggoner, Carrollton, Illinois, died July 14, 1944, aged 77 years.

Dr. Edwin D. Watkins, Memphis, Tennessee, died July 31, 1944, aged 62 years.

Dr. Cephas J. Wells, Bartlesville, Oklahoma, died September 9, 1944, aged 79 years.

Dr. John E. Virden, New York, New York, died August 30, 1944, aged 81 years.

Miscellaneous

A six-month course for orthoptic technicians will be given by The George Washington University School of Medicine, Washington, D.C., beginning February 5, 1945. Trainees must be sponsored by certified ophthalmologists. The fee for the course is $250.00. For further details write to Dr. Ernest Sheppard, School for Orthoptic Training, The George Washington University School of Medicine, 1335 H Street, N.W., Washington 5, D.C.

An orthoptic clinic has been established at the James Whitcomb Riley Hospital for Children at Indianapolis to provide special training for children who have difficulty in eye focusing and to supplement surgery for correction of strabismus.

Societies

The Washington, D.C., Ophthalmological Society elected the following officers for the 1944-1945 season: Dr. Harold R. Downey, president; Dr. John R. Lloyd, vice-president; and Dr. Richard W. Wilkinson, secretary-treasurer.

The officers of the Milwaukee Oto-Ophthalmic Society for 1944-1945 are: Dr. Leon H. Guerin, president; Dr. Ralph T. Rank, vice-president; and Dr. Frank G. Treskow, secretary-treasurer.

At the meeting of the Eastern Pennsylvania Association of Eye, Ear, Nose, and Throat Physicians in Wilkes-Barre on May 10, 1944, it was unanimously decided to change the name of that organization to the Pennsylvania Academy of Ophthalmology and Otolaryngology.

The following officers were elected: Dr. Lewis T. Buckman, president; Dr. Roy Deck, first vice-president; Dr. M. M. Rosenberg, second vice-president; Dr. Daniel S. DeStio, third vice-president; Lieut. Comdr. Sterling F. Mengel (MC) U.S.N. (on active duty), secretary; Dr. Paul C. Craig, secretary pro tem; and Dr. James J. Monahan, treasurer.

The scientific program consisted of the following papers: "Dentigerous cyst" by Dr.

Thomas R. Gagion; "Anatomy of middle ear and mastoid" by Dr. Horace J. Williams; "Neuropsychiatric aspects of ophthalmology and otolaryngology" by Dr. L. Vosburgh Lyons; "Ocular infections" by Dr. Isadore Givner; and "Sinusitis" by Dr. Blake F. Donaldson.

At the forty-ninth annual meeting of the Seaboard Medical Association of Virginia and North Carolina, December 5th to 7th, Dr. Antonio A. Burke, Norfolk, Virginia, presented a paper on "Glaucoma with especial relation to early treatment."

The second annual clinical conference of the Chicago Medical Society will be held from February 27th to March 1st at the Palmer House in Chicago. Dr. Peter C. Kronfeld, Chicago, will be among the guest speakers.

At the meeting of the Washington, D.C., Ophthalmological Society on November 6, 1944, Dr. Frank Walsh of Baltimore, the guest speaker, discussed "Some syphilitic involvements of the optic nerve." Dr. James S. Dryden reported a case, entitled "Glaucoma, acute, secondary to luxated intumescent lens." The following case presentations were made: "Detachment of the retina" by Dr. Sterling Bockoven; "Fractured skull with bitemporal hemianopia" by Dr. Joseph Dessoff; "A case of tuberculous choroiditis" by Dr. Thomas A. Egan; "An ocular myasthenia gravis" by Dr. Dorothy B. Holmes; "Complete central blindness of unknown cause" by Dr. Thomas R. Rees; and "Tear in Descemet's membrane" and "Gonorrheal conjunctivitis in adult treated with penicillin" by Dr. Roy A. Stewart.

At the regular monthly meeting of the Milwaukee Oto-Ophthalmic Society, held jointly with the Milwaukee Academy of Medicine on December 19th, Dr. James Watson White, New York, conducted an all-day course on "Ocular muscles."

The Dallas Southern Clinical Society will hold its fifteenth annual Spring Clinical Conference, March 19-22, 1945. Among the guest speakers will be Dr. Edmund B. Spaeth, Philadelphia.

Personals

Major Middleton E. Randolph (MC), Chief of the Ophthalmology Branch, Surgical Consultants Division, Office of the Surgeon General, has been assigned liaison officer with the Committee on Sensory Devices, Office of Scientific Research and Development, it has been recently announced.

The Cleveland Community Fund presented Drs. Charles I. Thomas and William E. Bruner with the distinguished service award for outstanding work in the field of sight restoration.

On November 24th, the Saint Louis Ophthalmic Society gave a dinner in honor of two of its members, Dr. John Green and Dr. Lawrence T. Post, past presidents, respectively, of the American Ophthalmological Society and the American Academy of Ophthalmology and Otolaryngology. About 50 members and guests were present. Dr. Frederick E. Woodruff read a paper on, "The history of ophthalmology in Saint Louis."